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1877.

TRANSACTIONS

OF

The American Dental Association

AT ITS

SEVENTEENTH ANNUAL SESSION,

HELD AT CHICAGO,

AUGUST 7th, 8th, 9th, and 10th, 1877.

PUBLICATION COMMITTEE:

M. S. Dean, G. H. Cushing, H. Judd.

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The AMERICAN DENTAL ASSOCIATION, although formally accepting and publishing the reports of the various Standing Committees, and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution.— *Constitution.*

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION,

SESSION OF 1877.

BY C. STODDARD SMITH, SECRETARY.

THE AMERICAN DENTAL ASSOCIATION assembled for its seventeenth annual session at the Grand Pacific Hotel, Chicago, on Tuesday, August 7th, 1877.

The President, DR. G. W. KEELY, called the meeting to order at 10 o'clock, A. M., and DR. MORGAN, of Nashville, opened the exercises with prayer.

The roll of qualified members was then called and the following members answered to their names; those marked with an * not being present but forwarding their dues:

ATKINSON, W. H.....41 E. 9th St., New York.
ALLPORT, W. W.....208 Wabash Ave., Chicago, Ill.
ALLEN, JOHN.....W. 34th St., New York.
*AMBLER, H. L.....114 Euclid Ave., Cleveland, O.
ANTES, R. H.....Geneseo, Ill.

BROCKWAY, A. H.....13 Greene Ave., Brooklyn, N. Y.
BARKER, G. T.....Philadelphia.
*BIRGE, J. J.....410 Kearney St., San Francisco, Cal.

Brown, Seneca B.....Fort Wayne, Ind.
Brophy, T. W.....126 State St., Chicago, Ill.
*Butler, C. R.....114 Euclid Ave., Cleveland, O.
Brewster, Thos. K.....Oskaloosa, Iowa.
Bogue, E. A.....21 E. 20th St., New York.
*Bronson, W. A.....8 E. 34th St., New York.
Billing, H. J.....Louisville, Ky.
Black, G. V.....Jacksonville, Ill.
*Brackett, C. A.....113 Thames St., Newport, R. I.

*Colton, A.....Hudson, N. Y.
Cushing, Geo. H.....174 State St., Chicago, Ill.
Crouse, J. N.....734 Michigan Ave., Chicago, Ill.
*Chaim, M. L.....30 Cooper Institute, New York.
Chase, H. S.....2635 Washington Av., St. Louis, Mo.
Chapman, A. S.....Princeton, Ill.
Clancey, D. W.....Cincinnati, O.
Campbell, John.....Bloomington, Ill.
Cook, C. D.....133 Pacific St., Brooklyn, N. Y.
Chittenden, C. C.....Madison, Wis.
Cummings, W. G.....Sturgis, Mich.
Clapp, J. L.....157 Clark St., Chicago, Ill.
Cassidy, J. S.....Covington, Ky.
*Canine, J. F.....170 5th Avenue. Louisville, Ky.

Dean, M. S.....174 State St., Chicago, Ill.
Davis, K. B.....Springfield, Ill.
Dyer, W. C.....1135 Wabash Ave., Chicago, Ill.
Driggs, Stoddard.....Lexington, Ky.
Denise, O. H.....Burlington, Iowa.
*Daboll, G. C.....Buffalo, N. Y.
*Dunn, C. E.....Louisville, Ky.
*Doyle, Oscar B.....Louisville, Ky.

*Essig, C. J.....1533 Locust St., Philadelphia.
Essig, Ira J.....1533 Locust St., Philadelphia.

Fillebrown, Thos.....Portland, Maine.
Friedrichs, Geo. J.....155 St. Charles St., New Orleans, La.
Freeman, A. W.....675 Wabash Ave., Chicago, Ill.
Field, Geo. L.....Detroit, Mich.
Freeman, D. B.....16 Aberdeen St., Chicago, Ill.
*Farrar, J N.....103 So. Oxford St., Brooklyn, N. Y.
*Freeman, S. A.....416 Main St., Buffalo. N. Y.
Fisher, Henry.....St. Louis, Mo.
Freeman, R. R.....Nashville, Tenn.
*Flagg, J. Foster.....106 N. 11th St., Philadelphia.

GODDARD, W. H.....157 W. Chestnut St., Louisville, Ky.
*GAYLORD, E. S.....New Haven, Conn.
GARDINER, F. H. .....142 Dearborn St., Chicago, Ill.

*HILL, J. S .....Gettysburg, Pa.
HARLAN, A. W.....70 Dearborn St., Chicago, Ill.
HAND, M. S.....Joliet, Ill.
HONSINGER, E.....318 Park Ave., Chicago, Ill.
HURTT, J. M.....Peoria, Ill.
HOWE, W. S.....Cincinnati, O.
HARRIS, J. A.....Pontiac, Mich.
HALL, J. W.....St. Louis, Mo.
HOLMES, E. S.....Grand Rapids, Mich.
HACKER, T. S.....Indianapolis, Ind.
*HUNTER, F. A.....192 7th St., Cincinnati, O.
HAWXHURST, D. C.....Battle Creek, Mich.
*HOOPER, J.....Owenton, Ky.

INGERSOLL, L. C.....Keokuk, Iowa.

JUDD, HOMER..... 1605 Washington Av., St. Louis, Mo.
JACKSON, H. H.....Detroit, Mich.

*KELLY, R. E.....Ashtabula, O.
KEELY, G. W.....Oxford, O.
KEELY, C. J.....Oxford, O.
KIDD, J. B.....Lexington, Ky.
KULP, W. O.....Davenport, Iowa.
KOCH, C. R. E.....67 Washington St., Chicago, Ill.
KITCHEN, C. A.....Rockford, Ill.
KEITH, H. H.....615 Olive St., St. Louis. Mo.

LATHROP, JOSEPH.....152 Woodward Ave., Detroit, Mich.

*MCMILLAN J. T.....Paris, Ky.
MARRINER, J. FRANK.....Ottawa, Ill.
MORGAN, W. H.....Nashville, Tenn.
MANSFIELD, H. A .....Evanston, Ill.
MC DONALD, G. B.....Conneautsville, Pa.
*MC KELLOPS, H. J.....615 Olive St., St. Louis, Mo.
MOORES, W. S.....Maysville, Ky.
MC QUILLEN, J. H.....2100 Arch St., Philadelphia.
MATTESON, C. F.....Chicago, Ill.
MC COY, J. C.....Boonville, Mo.
*MORRISON, W. N..... St. Louis, Mo.
MORGAN, J. B.....Davenport, Iowa.
*MC MANUS, JAMES .....Hartford, Conn.

Noel, L. G. ..... Nashville, Tenn.
Nichols, Gorton ..... 308 W. Adams St., Chicago, Ill.
Noyes, Edmund ..... 103 State St., Chicago, Ill.
*Northrop, A. L. ..... 44 W. 46th St., New York.

Osmond, E. ..... Cincinnati, O.
Odell, F. M. ..... 18 W. 11th St., New York.

*Palmer, S. B. ..... Syracuse, New York.
Palmer, Edgar ..... La Crosse, Wisconsin.
Pruyne, Charles P. ..... 70 Dearborn St., Chicago, Illinois.
Palmer, Corydon ..... 102 W. 38th St., New York.
*Peirce, C. N. ..... 501 N. 7th St.; Philadelphia, Penn.

Rehwinkel, F. H. ..... Chillicothe, Ohio.
Rawls, A. O. ..... Lexington, Kentucky.
Rix, John ..... Fort Madison, Iowa.
Rathbun, R. S. ..... Lyons, Iowa.

Smith, H. A. ..... 286 Race St., Cincinnati, Ohio.
*Sage, H. L. ..... Bridgeport, Conn.
*Stockton, C. S. ..... Newark, New Jersey.
Shepard, L. D. ..... 100 Boylston St., Boston, Mass.
Stone, E. C. ..... Galesburg, Ill.
Swain, E. D. ..... 67 Washington St., Chicago, Ill.
Sturgiss, S. M. ..... Quincy, Ill.
Spalding, C. W. ..... St. Louis, Mo.
Smith, C. Stoddard ..... Elgin, Ill.
Swartley, J. S. ..... 749 Michigan Ave., Chicago, Ill.
Shriver, F. M. ..... Glenwood, Iowa.
Smith, P. T. ..... Burlington, Iowa.
Smith, Joshua ..... 1046 Indiana Ave., Chicago, Ill.
Southwick, A. P. ..... Buffalo, N. Y.
Swasey, J. A. ..... 1124 Michigan Ave., Chicago, Ill.
*Smith, D. D. ..... 1417 Walnut St., Philadelphia.

Taft, J. ..... 117 W. 4th Street, Cincinnati, O.
Thomas, George R. ..... Detroit, Mich.
Talbot, E. S. ..... 238 N. Clark Street, Chicago, Ill.
Taft, Wm. ..... 117 W. 4th Street, Cincinnati, O.

Webb, M. H. ..... Lancaster, Pa.
Waters, G. F. ..... 8 Beacon Street, Boston, Mass.
Williams, Jacob L. ..... 6 Mt. Vernon St., Boston, Mass.
Wells, Merritt ..... Indianapolis, Indiana.

WILSON, I. P.....Burlington, Iowa.
WATLING, J. A.....Ypsilanti, Michigan.
*WHEELER, C. F.....Albany, New York.

The reading of the minutes of the last session being called for, was then proceeded with, but upon motion the further reading was dispensed with.

The local committee of arrangements, by its chairman, Dr. Dean, made the following report, which upon motion was accepted and adopted, together with the accompanying printed programme.

Your local committee respectfully submit the following report :

After examining the assembly rooms in this city both public and private, we concluded that the one you now occupy was the best adapted to the comfort and the wants of the association. The use of this and the adjacent committee rooms, have been generously donated by the proprietor, Mr. Drake.

You have all been apprised of the special rates offered by the leading hotels in this place and are, doubtless, comfortably and satisfactorily provided for.

We have prepared a programme and order of business which have been approved by the executive committee, and which, we think, if adopted will prevent confusion and loss of time to the association.

Provision has been made for a microscopical exhibition, Wednesday, from 8 to 10 in the morning. This will take only thirty minutes out of the regular order of business, and those particularly interested in histology will have opportunities for examining specimens at such times as may suit the convenience of the committee on histology, without interfering with the regular business.

It will be observed that no provision has been made for clinics. Your committee have observed that this feature in our association has lessened in interest from year to year, while the feeling has been continually growing stronger among the members that it should be abolished by our national association and that such instruction should be left to the state and local societies. For some years after the organization of this body this practical teaching was essential, but the various state and local societies which have been organized throughout the country have, by assuming this work, rendered this feature in our association non-essential and unadvisable.

Provision has been made for two evening sessions,—Wednesday for regular business and Thursday for the election of officers, etc.

Your local committee would like nothing better than to give wing to our eloquence in a regular address of welcome, but we know you will *most*

cheerfully excuse us;—besides, we are not willing to set this example lest it should be taken as a *precedent* and we in turn might have to submit to a like ordeal by our successors.

That you are all welcome, we hope our acts during your stay with us will prove.

M. S. DEAN, Chairman.

Dr. Shepard moved the adoption of the following resolution:

Resolved, That dentists not resident in the United States who may be present, and whose names may be approved by the executive committee, are hereby invited to seats upon the floor, and to participate in the discussions.

Dr. Atkinson moved to amend so as to include physicians, and the resolution as amended was carried.

The committee on credentials made a partial report, which as finally completed by various supplementary reports, was accepted and adopted as follows:

American Academy of Dental Science—Jacob L. Williams.

Chicago Dental Society—H. A. Mansfield, C. P. Pruyne, G. W. Nichols, Edward Noyes, D. B. Freeman, Joshua Smith.

First District Dental Society of the State of New York—W. H. Atkinson.

Dental School of Harvard University—L. D. Shepard.

Dental College of the University of Michigan—J. A. Watling.

Dental Society of the State of New York—A. P. Southwick.

Indiana State Dental Association - T. S. Hacket.

Illinois State Dental Society—M. F. Hand, E. C. Stone, K. B. Davis, J. M. Hurtt, A.S. Chapman, S. M. Sturgiss, John Campbell, Frank H. Gardiner, C. R. E. Koch, T. W. Brophy, C. A. Kitchen, E. S. Talbot, G. V, Black, C. F. Matteson, R. H. Antes, J. L. Clapp.

Iowa State Dental Society—F. M. Shriver, I. P. Wilson, John Rix, L. C. Ingersoll, P. T. Smith, J. K. Brewster, R. S. Rathbun, O. H. Denise, J. B. Morgan.

Kentucky State Dental Association—John B. Kidd, Stoddard Driggs, William H. Goddard, A. O. Rawls.

Maine Dental Society—Thos. Fillebrown.

Missouri State Dental Association.—J. C. Mc Coy.

Missouri Dental College—Homer Judd.

Michigan Dental Association—J. A. Harris, H. H. Jackson, J. Lathrop, D. C. Hawxhurst.

Mississippi Valley Dental Association—Charles J. Keely, W. S. Howe, William Taft.

New Orleans Dental Association—George J. Friedrichs.

Nashville Dental Association—R. R. Freeman.
Pennsylvania State Dental Society—M. H. Webb, J. B. McDonald.
Philadelphia Dental College—J. H. McQuillen.
Pennsylvania College of Dental Surgery—G. T. Barker.
St. Louis Dental Society—J. W. Hall. H H. Keith, Henry Fisher.
Western College of Dental Surgons—C. W. Spalding.
Wisconsin State Dental Society—Edgar Palmer.

Respectfully submitted,

L. D. SHEPARD,
J. N. CROUSE, } *Committee.*
M. H. WEBB,

The report of the publication committee was then called for, and was read by the chairman, as follows:

The publication committee have to report that they have had published 500 copies of the transactions of 1876 in the ordinary form, about 175 of which have been distributed in the usual manner to those entitled to them, and the balance remain on hand. The amount expended by your committee for this and other purposes, is as follows:

Printing Transactions as per bills		$388 00
Wrappers for mailing		80
Postage		16 33
Express, etc		3 50
Exchange		25
Printing Postals		1 75
Printing Blanks for Treasurer		12 00
		422 63
By Cash from Treasurer	$300 00	
Balance due Committee	122 63	
		$422 63

Your committee feel much chagrined at the late day at which the transactions were finally issued from the press. In explanation of the same they have to say that the cause was entirely beyond their control. They contracted (through their chairman,) for a stenographic report of the discussions, which was to be furnished within a month from the adjournment, and it was the intention to issue the volume especially early during the fall of last year, as it was known by the chairman that he would be so situated during the winter as to be unable to get the work done. The stenographer however failed to furnish the report as agreed, and did not do so until the latter part of December, at which time and for some months subsequently, the personal affairs of the chairman were such that it was impossible for him to begin the work until the middle of April, since which time it has been urged forward with all possible dispatch, but the very large amount of matter and the unusual number of authors, to whom proofs must be sent, have consumed the time in spite of every effort, until the latter part of July.

The amount of matter as above intimated, is very large; one-half at least greater than the average. The book is printed in brevier, a small sized type, and even in that comprises 232 pages of matter. Had it been printed in the style of previous years it would have made 25 per cent. additional. The increase is no doubt owing to the fact that as it was the centennial year meeting of this body an unusual number of members of committees made individual reports, and several of them were of extreme length.

The cost of the volume, considering the amount of matter has been very reasonable, being about 80 cents per copy. Your committee deemed it advisable to have a somewhat larger number than usual issued, that all desiring copies might be supplied, as no doubt many will wish to preserve the centennial record of this association,—and they recommend that they be offered for sale by advertisement or otherwise.

C. STODDARD SMITH, Chairman.

The report was accepted and adopted.

The report of the special committee on sections, appointed last year was then read by the chairman, Dr. Atkinson, as follows:

To the American Dental Association:—Your committee, in obedience to your instructions to consider the subject of forming this Association into permanent sections, and to lay before you the result of that consideration, respectfully report, that they have been strongly impressed with the importance and indeed the necessity, in order to execute properly our mission, of applying to every subject within the scope of our investigation and research, the suggestion of Dr. J. Foster Flagg with reference to one—Pathology.—that is the constitution of permanent sections, to be the analogues of the committees hitherto appointed to prepare and present papers to this body.

The principle of division of labor and concentration of effort, so extensively adopted in the successful prosecution of ends in so many business interests, and that have been so happily practicalized in this body, would seem to apply with peculiar force to our investigations and researches, since we have before us a field so wide, and embracing so many branches of science, that no one man can hope to master them all or even a considerable number of them and at the same time pursue the practice of his profession.

It can therefore hardly be doubted that the members of this association can accomplish more for the advancement of the interests of our profession by persistently pursuing scientific inquiries, as connected therewith, in a single direction or on a limited number of subjects than by the present system of preparing papers or essays year after year, and each year on different subjects.

Holding these views your committee present for your action the following resolutions:

Resolved, That the membership of this association be and is hereby divided into.....permanent sections, each section to be composed of such members as may elect to unite and form that section.

Resolved, That it shall be the duty of each member of this association to connect himself with some one of these sections, but that he shall be free to follow his own preferences as to the particular channel in which he will labor and may if he so desires be a member of two or more sections.

Resolved, That the members of each section shall at some time during each annual meeting of the association, elect a chairman and such other officers of the section as they may see fit, whose duty it shall be to see that the labors of the section are conducted in the manner calculated to secure the best results.

Resolved, That each section shall have charge of one of the subjects or branches essential to scientific dentistry, and through its chairman or such other member as it may select, report upon the same to the association at each annual meeting.

Resolved, That after the several sections shall have been fully organized and in working condition, it shall be the duty of each chairman to furnish the latest and best information in the possession of his section upon any point connected with its subject, to any member of another section who through the chairman of his own section may apply to him for such information.

Your committee have omitted the division and nomination of the subjects or branches essential to scientific dentistry. Should this report be adopted they can be easily named.

The number of permanent sections is left blank, as that must correspond to the number of subjects or branches determined upon.

Respectfully submitted,

R. FINLEY HUNT,)
W. H. MORGAN, - *Committee.*
W. H. ATKINSON,)

On motion of Dr. Barker, the report was accepted. Dr. Taft moved to lay it upon the table until Wednesday afternoon, which motion was on motion of Dr. Spalding amended so as to read Thursday, at 10 o'clock A. M. and the motion as amended was carried.

The Secretary then read a letter from the officers of the Board of Trade, inviting the members to visit that institution, and the invitation was accepted and thanks tendered therefor.

The Executive Committee reported H. H. Winne, D. D. S., of Shanghai, China, as entitled to the privileges of the floor under the resolution of invitation to visiting dentists.

On motion of Dr. Shepard, the reports of Standing Committees were then taken up, and the Committee on Physiology was called. The chairman Dr. Dean, read letters from the other members of the committee, Dr. Winder of Baltimore, who was detained by military duty, and Dr. Farrar of Brooklyn, which latter was accompanied by a report or paper. Dr. Dean then read his report as chairman of the Committee on Physiology.

Discussion followed, which was participated in by Drs. Atkinson, Chase, and Waters.

Dr. Taft moved that the privileges of the floor be extended to Dr. Abram Robertson, formerly of Wheeling. Va., but now of New Hampshire, from whose eyes the light of day had been shut out for eight years. Carried.

The discussion on Dr. Dean's paper was then resumed, and remarks were made by Drs. Robertson, Barker, Atkinson. Judd, Waters, Spalding, and McQuillen, after which the meeting adjourned.

FIRST DAY — AFTERNOON SESSION.

The meeting was called to order pursuant to adjournment, by the President. The minutes of the morning session were read and approved.

The subject of physiology was resumed, and the reading of a paper by Dr. Farrar on "North Light versus Sun Light," was postponed until the next morning.

The consideration of the subject was postponed, and Pathology and Surgery was called, but upon motion the vote by which this was done was reconsidered, and Dr. Ingersoll of Iowa, read a volunteer paper entitled "Is the Dental Pulp essential to the integrity of the Tooth Structure?"

The paper was then discussed, by Drs. Rawls, Barker, Sturgiss, Robertson, Ingersoll, Allport, Jno. Allen, Atkinson, Crouse, Rehwinkel, Morgan, Noyes, and McDonald, after which the meeting adjourned.

SECOND DAY—MORNING SESSION.

The meeting was called to order at 10 o'clock by the President. The minutes of the last session were read and approved.

Miscellaneous business being in order the report of the Treasurer was read, accepted and adopted, as follows:

Wm. H. Goddard, in account with American Dental Association, 1876.

1876.		
Aug 1, To balance account last year	$ 175 00	
" cash received for dues during year	715 00	
Cr.		
By paid telegram to Europe		$ 15 72
" " Janitor		25 00
" " Secretary's salary		100 00
" " Treasurer's "		100 00
" " Chairman Publishing Committee		340 64
" " Dues refunded		5 00
" " Express ch'gs, cards, paper and stamps, etc.		15 00
		601 36
Balance this day August 7th		288 64
	$890 00	$890 00

Chicago, Ills., August 7, 1877. WM H. GODDARD, Treasurer.

We have examined the report of the Treasurer and find it correct.

L. D. SHEPARD,
M. H. WEBB, } *Committee.*
J. N. CROUSE,

Chicago, Ills., August 9, 1877.

On motion of Dr. Barker, the paper of Dr. Farrar on Physiology laid over from yesterday was taken up and read by the Secretary. The paper was then discussed by Drs. McQuillen, Spalding, Waters, Rehwinkel, Thomas, Barker, Kulp, Edgar Palmer, A. W. Freeman, Atkinson, R. R. Freeman, Noyes, and Judd, after which the subject was passed.

Dr Spalding moved an adjournment to accept the invitation to visit the Board of Trade. Carried, and the meeting adjourned.

SECOND DAY—AFTERNOON SESSION.

The meeting was called to order at 3 o'clock by the President. The minutes of the morning session were read and approved.

Dr. Rehwinkel called attention to Dr. Adolph Peterman's Almanac of Dentists in the German Empire, in connection with lists of graduates of Dental Colleges, and other useful compilations. It was moved that in consideration of the labors expended in the preparation of this book, Dr. Adolph Peterman, of Frankfort-on-the-Maine, and Dr. Geo. Von Langstorf of Freiburg, Baden, be elected Honorary Members of the Association, and upon the ballot being taken they were unanimously elected. The Corresponding Secretary was instructed to notify them of the action taken and the reasons therefor.

A congratulatory telegram from the 4th District Dental Society of New York, in session at Saratoga was read by the Secretary, and on motion the President and Secretary were instructed to answer the same.

The Committee on Credentials made a further report.

The subject of Pathology and Surgery was called, and Dr. Rehwinkel read a paper entitled "Pyorrhœa alveolaris," which was discussed by Drs. Rawls, Shepard, Corydon Palmer, Barker, Atkinson, McQuillen, Rehwinkel, and Judd, after which the meeting adjourned.

SECOND DAY—EVENING SESSION.

The Association was called to order at 8 o'clock P. M. by the President. The minutes of the previous session were read and approved.

Under the head of miscellaneous business Dr. Allen offered the following resolution, which after some debate was indefinitely postponed:

Be it Resolved, That a Committee of three be appointed by the chair, to revise and amend such portions of our present Code of Dental Ethics as do not harmonize with each other, and report the same at our next annual meeting.

On motion, Dr. Edgar Palmer read a volunteer paper entitled "The Potency of Alcohol to cause Dengeneracy of the Human Teeth," which was discussed by Dr. Atkinson and the subject was passed.

The subject of Histology and Microscopy was called for, but there were no reports and the subject was passed after a few remarks by Dr. McQuillen.

The subject of Chemistry was taken up, and a report written by Dr. J. S. Cassidy was read by Dr. Taft, after which the meeting adjourned.

THIRD DAY — MORNING SESSION.

The meeting was called to order by the President. The minutes of the preceeding session were read and approved.

The Special Order was the report of the Committee on Sections, which was called up by the President at the hour named. The report was read and discussion ensued.

Dr. Barker moved that the report be recommitted and three new members added to the Committee. Carried.

On motion, the vote to recommit was reconsidered and the discussion was renewed.

Dr. Spalding moved to increase the number of the Committee to ten, and to instruct the Publication Committee to print and distribute the report as it stands.

Dr. Shepard moved that the final report of the Committee should be printed and distributed to members, at least one month previous to the next meeting.

Dr. Barker accepted Dr. Shepard's amendment.

A division of the question being called for, the question was put on the motion to increase the Committee from three to ten members, which motion was carried.

The previous question was then ordered and the motion as amended and reduced to writing, was put and carried, as follows :

Resolved, That the Committee be increased to ten members, and that the report presented by the Committee of three be recommitted to said Com-

mittee for amendment or reconsideration, and that they be instructed to print the results of their deliberations and that a copy be mailed to each member of the Association, at least one month before the next annual meeting.

So the report was recommitted to an enlarged Committee of ten, who were appointed by the Chair subsequently, but are for convenience inserted in this place, as follows:

Drs. R. Finley Hunt, W. H. Atkinson, and W. H. Morgan, (original committee); C. W. Spalding, St. Louis; H. Judd, St. Louis; H. A. Smith, Cincinnati; G. T. Barker, Philadelphia; J. H. McQuillen, Philadelphia; J. N. Crouse, Chicago; L. D. Shepard, Boston.

The subject of Chemistry was then taken up, and Dr. Taft read a report written by Dr. Essig, which was discussed by Drs. Osmond, Noel, Judd, and Fredericks, when the subject was passed.

The Committee on Therapeutics was called, and Dr. Shepard read a report by Dr. Brackett on that subject, after which the meeting adjourned.

THIRD DAY—AFTERNOON SESSION.

The meeting was called to order at 2:30 P. M., the president in the chair. The minutes of the preceding session were read and approved.

The Committee on Credentials made a supplementary report.

The Executive Committee reported that they had filled certain vacancies in their Committee by placing Dr. Fillebrown upon the 1st Division, transferring Dr. Cushing to the 3d Division, and adding Drs. Judd and Bogue to the same.

The subject of Therapeutics was resumed and Dr. Odell read the report of the Committee, which was discussed by Drs. Atkinson, Judd, Rehwinkel, Nichols and Barker, after which the subject was passed.

The Committee on Operative Dentistry was called, and a report was read by Dr. Cushing, the Chairman, which was followed by one by Dr. Harlan, after which the subject was discussed by Drs. Rawls, Howe, and Webb, and the meeting adjourned.

THIRD DAY—EVENING SESSION.

The meeting was called to order by the President at the usual hour. The minutes of the morning session were read and approved.

Miscellaneous business was called up, and Dr. Taft offered the following Amendment to the Constitution :

Change Art. III, Sec. 4, so as to read : "All delegates shall be practitioners of dentistry; they shall receive their appointment only from permanently organized *State* Dental Societies and Dental Colleges," etc.

Dr. Keely offered the following Amendment to the Constitution :

Change Art. III, Sec. 1, so as to read, "Each local Society may send one (delegate) for every *fifteen* of its active members," etc.

[The words in italics are those in which changes are made.---SEC.]

Both of these proposed Amendments were laid over until next year, according to the Constitution.

The following resolutions were adopted :

Resolved, That the Treasurer be and is hereby instructed to notify all permanent members of the amount of their arrears, as early as convenient after the close of each session. (Standing resolution.)

Resolved, That the salaries of the Secretary and Treasurer be paid.

Dr. Taft moved that a Committee of three on the Nomenclature and Terminology used by the dental profession, be appointed, to report at the next meeting. Carried, and Drs. Taft, Atkinson and Judd were appointed as such Committee.

The Special Order, the election of officers, was then taken up and proceeded with, with the following result.

President—F. H. REHWINKEL, Chillicothe, Ohio.
First Vice-President—L. D. SHEPARD, Boston, Mass.
Second Vice-President—GEORGE T. BARKER, Philadelphia, Pa.
Corresponding Secretary—M. H. WEBB, Lancaster, Pa.

Recording Secretary—M. S. Dean, Chicago, Ill.

Treasurer—W. H. Goddard, Louisville, Ky.

Executive Committee—[New Members,] Drs. H. Judd, W. H. Morgan and Thos. Fillebrown.

The Society then proceeded to ballot for the place of next meeting, and upon the first ballot Niagara was selected.

The meeting then adjourned.

FOURTH DAY—MORNING SESSION.

The meeting was called to order at the usual hour, the President in the chair. The minutes of the preceding session were read and approved.

Dr. Dean proposed the names of the following gentlemen as honorary members, and upon the ballot being taken, they were unanimously elected:

J: Smith Turner, M. R. C. S., Chas. S. Tomes, M. A., M. R. C. S., John Tomes, F. R. S., M. R. C. S., all of London. E. Magitot, M. D., Mordaunt Stevens, M. D., D. D. S., M. R. C. S., Paris. Fr. Wedl, Vienna.

Dr. Hawxhurst offered the following Amendment to the Constitution:

Add to the first clause of Sec. 4, Art. III, the following: "No Dental College shall be eligible to representation in this Association which does not require two courses of lectures as a condition of graduation."

Laid over for one year.

Dr. Taft spoke to a question of privilege, and in the same connection Dr. Allport offered the following resolution, which was unanimously adopted:

Resolved. That this Association fully endorses the action of its Treasurer, Dr. W. H. Goddard, in exacting dues of all members before allowing them to take part in the proceedings, as in so doing he is only carrying out the law.

Dr. Edgar Palmer offered a resolution providing that to prevent time being taken up by volunteer papers, no such paper should hereafter be read

until all the reports of Standing Committees shall have been presented and discussed. Lost.

Dr. Kulp tendered the thanks of Dr. Winne of China, for the courtesies extended to him.

The regular order was then proceeded with, and the subject of Operative Dentistry was taken up, and remarks were made by Dr. Corydon Palmer.

On motion of Dr. McQuillen, the time of speakers was limited to five minutes, except by unanimous consent.

The discussion on Operative Dentistry was then resumed and was participated in by Drs. Hall, Waters, Taft, Thomas, McDonald, Barker, Rawls, Atkinson, Ingersoll, Allport, and John Allen, after which the subject was passed.

The subject of Mechanical Dentistry was called for, and the Secretary read a brief letter from Dr. Morrison on the subject, which was then passed.

The subject of Dental Education was then taken up, and a report was read by Dr. Fillebrown, a member of the committee, which closed with a preamble and resolutions, which the author desired to put to a vote after the subject should have been discussed.

[These resolutions were laid on the table till a later period and were then voted upon, and will be found on page 27.—Sec.]

Dr. Crouse then read a report on the same subject, after which the meeting adjourned till 2:30 P. M.

FOURTH DAY—AFTERNOON SESSION.

The meeting was called to order at the appointed hour, the President in the chair. The minutes of the morning session were read and approved.

Dr. Shepard offered the following resolutions, which were adopted :

Resolved, That the Treasurer be authorized to pay the drafts of the Publication Committee as required.

Resolved, That the American Dental Association tender their thanks to J. B. Drake & Co., proprietors of the Grand Pacific Hotel, Chicago, for

their liberality in furnishing to the Association the excellent assembly room in which the meetings have been held, together with stationery, attendance etc., free of expense to the Association.

Resolved, That it is the opinion of this Association that the Grand Pacific Hotel stands eminent for liberality and skillful management.

Resolved, That the thanks of this Association be tendered to the proprietors of the Palmer, Sherman, Clifton, Matteson and Tremont Houses, for a liberal reduction in rates.

On motion it was voted to suspend the rules at the close of miscellaneous business, to hear the report of the Committee on Credentials.

The Committee on Nominations made their report, which on motion was accepted and adopted as follows :

PHYSIOLOGY.

M. S. Dean, J. H. McQuillen, C. W. Spalding.

PATHOLOGY.

W. H. Atkinson, G. R. Thomas, D. C. Hawxhurst.

HISTOLOGY AND MICROSCOPY.

G. V. Black, G. F. Waters, C. N. Peirce.

CHEMISTRY.

T. L. Buckingham, L. G. Noel, W. A. Bronson.

THERAPEUTICS.

F. M. Odell, L. C. Ingersoll, C. C. Chittenden.

OPERATIVE DENTISTRY.

H. A. Smith, L. D. Shepard, M. H. Webb.

MECHANICAL DENTISTRY.

A. L. Northrop, H. H. Keith, W. N. Morrison.

EDUCATION.

J. N. Crouse, Thos. Fillebrown, Geo. J. Friedrichs.

LITERATURE.

C. D. Cook, A. H. Brockway, W. H. Morgan.

ETIOLOGY.

D. C. Hawxhurst, D. W. Clancy, J. Frank Marriner.

PRIZE ESSAYS.

H. Judd, W. W. Allport, C. S. Stockton.

The Committee on Instruments and Appliances made their report, which was read by Dr. Brockway, and was accepted and adopted.

The subject of Dental Education was then resumed and remarks were made by Drs. Atkinson, Taft, Spalding, Barker, Judd, Black, Osmond, McQuillen, Shepard, and Fillebrown.

[The meeting here took a recess for the purpose of adjourning from the Assembly Room to a smaller room in another part of the building.]

On reassembling, Dr. Judd offered the report of the Committee on Popular Education, appointed some years since, the same being a printed pamphlet prepared by a similar committee of the Illinois State Dental Society. The report was accepted and laid over for consideration at the next annual meeting.

The discussion upon Dental Education was resumed, and remarks were made by Drs. Crouse and Spalding.

The rules were then suspended in order to vote upon Dr. Fillebrown's resolutions, which were as follows:

WHEREAS, Dentistry is a specialty of the science of medicine:

Resolved, That we esteem a sound and thorough medical education essential for the most successful practice of it.

Resolved, That we deem it expedient for the best interests of the profession of dentistry, that existing medical schools enlarge their courses so as to include efficient instruction in dentistry, in order that it may be placed on an equality with other specialties of medicine.

A division of the question being called for, the preamble and the first resolution were put to vote and carried. The second resolution was lost. The subject of Dental Education was then passed.

The subject of Dental Literature was then called for, and Dr. Shepard read the report of the committee.

The subject of Etiology being called up, Dr. Hawxhurst, Chairman, and Dr. Webb, a member, of that committee, each read a report, and the latter was adopted and endorsed.

Dr. Barker declined the Chairmanship of the Committee on Etiology, and on motion Dr. Hawxhurst was substituted.

The Committee on Prize Essays made a report, which was read by Dr. Morgan, and was accepted and adopted.

The following resolutions were adopted:

Resolved, That the thanks of the Association are hereby tendered to the profession of Chicago and the Chicago Dental Society for courtesies received.

Resolved, That the thanks of the Association be tendered to the retiring officers for the manner in which they have discharged their duties.

Dr. Atkinson moved to substitute Dr. Barker in place of Dr. John Allen, (who declined,) on the Committee on Sections. Carried.

The President appointed as the Local Committee of Arrangements for the next session, Dr. G. C. Daboll, Buffalo; G. L. Field, Detroit; and C. R. Butler, Cleveland. Also as members of the Publication Committee, Drs. G. H. Cushing and H. Judd.

The newly elected President was then conducted to the Chair and introduced, and the retiring and incoming Presidents each made a few appropriate remarks, after which the Association was declared adjourned, to meet at Niagara Falls, on the first Tuesday in August, 1878.

REPORTS

OF

STANDING COMMITTEES,

VOLUNTEER ESSAYS

AND

DISCUSSIONS.

REPORT

OF THE COMMITTEE ON

DENTAL PHYSIOLOGY.

By M. S. DEAN, Chairman.

Since the able report of last year, no new facts have come to the surface, nor have any new publications bearing upon the subject of Dental Physiology been brought to our notice. The recent work by Mr. C S. Tomes, "A Manual of Dental Anatomy, Human and Comparative," is the latest issue that contains any new and valuable researches in connection with this subject, and this was partially reviewed by myself at our last meeting. Since that time I have carefully perused this work, and I find that its value was by no means over-rated.

In accordance with a resolution adopted by this body, each member of your committee will report independently, and upon such branches of the subject as may suit his inclination or taste.

I shall then, occupy the brief time allotted to me, in discussing a few disputed points in physiology, and in doing this I may be drawn over the feeble line that separates it from the domain of pathology. If so I shall not shield myself behind the definition of Beale, who declares Pathology to be the "Physiology of disease," but shall claim my right to search *in whatever field* of science I please, for facts which may throw light upon the physiological principles under discussion.

As a sort of ground-work, then, for what may follow, and for the purpose of refreshing our memories, I will submit a few generally recognized facts without argument:

1. That the dentine is either formed by the direct calcification of the odontoblasts, or, is the product of a secretion of these cells. In either case it is the result of the odontoblasts. 2. That after the dentine has been developed, these cells, with one of their processes extending into and filling the dentinal tubes, are arranged in contact with each other upon the internal surface of the dentine, and form what was until recently supposed to be, the *membrana eboris*. 3. The odontoblast cells having accomplished this work of development, their legitimate office thereafter, is to perfect it, and to preside over its nutrition. 4. The dentine having no active functions to perform, the work of these cells is now comparatively light; and, following the law of all living bodies, their size and vigor are correspondingly diminished. 5. By the stimulus of irritation these odontoblasts (like all other cells) renew their activity, and again commence the labor of building up the structure, though not always in exact accordance with the original type. 6. Inasmuch as the dentinal tubes after the development of the dentine is completed (in magnitude), always become lessened; and inasmuch as in the teeth of persons of advanced age they frequently become entirely obliterated by lime salts, it would appear that there is a natural tendency or predisposition to an increased development during the life of the pulp; and, that this predisposition is often hastened or *determined* by the stimulus of irritation from a source external to it.

These propositions will I think, be substantially accepted by all. They are important facts to be borne in mind; and they bring me to the point which I have selected for discussion, viz.:

Does vital action play any part in producing any of the Structural Changes observed in the living dentine?

In discussing this subject I shall at this time entirely avoid the inquiry, whether the *living elements* of which the dentine is composed, do not modify in some degree the chemical affinities and by their vital force shield the tissues, in a measure, from destructive influences. That they do this I attempted to show in a paper read before the Odontological Society of N. Y. some two years ago. But the question now is, whether the changes which we observe in the structure of the living dentine when attacked by decay, are due to vital manifestations of the dentinal cells?—An affirmative answer to this question seems to me so reasonable, that its discussion would seem a waste of time, had not some able writers and distinguished physiologists lately opposed this view with uncommon ability. Foremost among

these, are, I believe Leber and Rottenstein, supported by such noted names as C. S. Tomes, Prof. Wedl, and many others less illustrious.

Messrs. Leber and Rottenstein, in their work on "Dental Caries and its Causes," speaking of the calcareous salts found in the dentinal tubes, say: "These calcareous deposits in the interior of the canaliculi are considered by Messrs. Tomes and Magitot (here he means J. Tomes) as the product of a vital action. We are still more inclined to believe that these calcareous deposits are formed by a purely chemical process; that is to say, by the residue resulting from the solution of the calcareous salts by contact with acids. In the work of caries a portion of the calcareous salts of the teeth is always dissolved out; these same salts, so dissolved, must by diffusion penetrate the canals toward the cavity of the pulp; there, in contact with a neutral or alkaline liquid which fills the interior of the canals, or which penetrates the dentinal fibrils a precipitate is formed." The most we can say of this is, that it is an ingenious hypothesis but a very complicate process. In another place, these authors say: "During the action of caries there are often formed calcareous deposits in the interior of the dentinal tubes, deposits which Mr. Tomes and Mr. Magitot have regarded of great importance. They are seen ranged singly or in groups, under the form of minute threads, or bundles of them more or less long; or else under the form of separate cylindrical granulations. On submitting them to the action of acids, they dissolve and leave most frequently an *organic residue* which *preserves the same form.*"

If the former statement of these gentlemen be true — that the lime salts dissolved out by the acids, enter the tubules from the external surface of the caries, and are there precipitated, this precipitate, this deposit is merely *crude* phosphate of lime. The molecules cannot be encapsulated by organic matter; and therefore, on submitting these deposits to the action of acids they *cannot* leave an "organic residue which preserves the same form." These deposits, then, in the dentinal tubes are, according to the showing of Leber and Rottenstein as truly organic as are the secondary deposits upon the inner surface of the dentine, and are, of course, the result of *vital action.*

If the data of these authors are correct this question is already settled without additional argument.

Under the head of "*Stationary Caries*" these authors say: "The

considerations presented by Messrs. Tomes and Magitot upon the cause which determines the stationary state of caries are founded upon the presence of calcareous deposits in the minute dentinal canals." They continue: "as the formation of these calcareous deposits cannot be attributed to a *vital action*, we are led to believe they are secondary, and that they become abundant only when from some cause the action of the acid has ceased; then the calcareous salts which existed in the state of solution are precipitated. Neither do we believe that the dentine can become harder in stationary caries, excepting perhaps the surface, where mechanical means such as friction or pressure, may produce a slight condensation."

It would appear then, according to Leber and Rottenstien, that the phenomena of stationary caries are due to *friction*, *pressure*, and the *precipitation* of lime salts in the dentinal tubules after the action of acids has ceased.

If these surfaces are submitted to sufficient friction and pressure to polish and condense them, it would seem that this solution of calcareous salts would be so quickly removed by these means as to render this theory impossible. This would be especially the case on the grinding surfaces of the upper teeth and the buccal surfaces of the lower teeth, where the gravitation of these salts would rather *prevent*, than facilitate, their entrance into the dentinal tubes.

Mr. C. S. Tomes concludes his remarks on the subject of vital action, in his Appendix to A System of Dental Surgery—in these words: "From the preceding observations it will appear that, inasmuch as no characteristic appearances can be found to distinguish caries, as occurring in living, from that attacking dead teeth, it seems that the hypothesis of vital action must be abandoned *in toto*."

In arriving at this conclusion it would seem to me that Mr. Tomes has not exercised his usual care in analyzing the evidence upon which it was based. He founds his opinion upon the "*appearances*" of the zones of transparency in the living teeth as compared with the dead teeth. From his own observations, which he says have been few, "he is inclined to think that the transparent zone is as constant in the decayed human teeth, used as artificial substitutes, as in the living teeth."

Now Messrs. Leber and Rottenstein, from whom he extensively quotes

in support of this view say, *most positively* that this zone of transparency is the result of the *withdrawal* of the lime salts, and Mr. Tomes himself says, in speaking of the translucent changes, "the tissues might be rendered more transparent either by the obliteration of the canals by calcification of their contents, or by the decalcification of the matrix." And in describing the zone of transparency, he says it "corresponds, in naked-eye, and microscopical appearance, to the dentine of the roots of the teeth of old persons," etc. And then again he says, "these old roots have been shown by actual chemical analysis to be *far more rich in lime salts* than ordinary healthy dentine."

These authors seem to judge solely from the *appearance* of these tissues, without the aid of chemical analysis, that these zones in the living, and in the dead teeth are structurally the same. How do they know this, if the dentine to which lime salts are *added* presents the same appearance as the dentine from which these salts have been *abstracted?*

We may fairly conclude then, without further argument, that the premises which these gentlemen furnish us are at least equivocal; and, that although the transparent zone in living and in dead teeth may be similar "in naked-eye, and microscopical appearance," yet there is no evidence that these zones are chemically and structurally alike, nor that vital action may not be the cause of one, while chemical action is the cause of the other.

You will bear with me, I trust a moment longer, since this point—the zone of transparency—is considered a very important one. Indeed Mr. C. S. Tomes, before bringing up his forces to attack this theory says, this "is the last remaining evidence of *supposed* vital action."

Messrs. Leber and Rottenstein, in speaking of these zones of transparency—"cones" they call them—say: "We find these cones in teeth attacked by caries at a period when the exterior surface of the enamel *has still its polish*, and consequently has *lost no portion of its substance.*" They figure such a tooth, in which the "cone" extends from the enamel nearly to the pulp.

Now how is this change in the dentinal structure, in the case cited, to be accounted for? Certainly not by the filling up of the tubes with calcareous matter entering from the external surface; for if so, from what source

is it derived? Not from a solution of the lime in the enamel or dentine; for these authors say, expressly, that "the enamel has lost no portion of its substance."

This changed appearance then must be the result of either chemical or vital action. It cannot have been produced, in this case, by the acid reagents entering the tooth-substance; for this would be a physical impossibility. Besides, even if it were possible for acids to thus penetrate the dentine, they would unite with the first affinity they met in their course, instead of traversing a calcareous structure to such a depth, and dispersing themselves over so extensive an area.

Again if this "cone" is the result of the withdrawal of calcareous salts from the matrix of the dentine, where have these salts gone? As they cannot have been dissolved out, they must have been removed — if removed at all — by absorption.

Finally, whether this "cone" was caused either by a *diminution* or by an *increase* of lime salts, this removal or deposition can be accounted for only upon the theory of *vital action.*

Thus far I have attempted only to show that the main arguments which have been advanced to refute the hypothesis of *vital action* are fallacious; and, that the facts upon which they are based, tend rather to establish than to overthrow this hypothesis.

I will now offer a few facts, and arguments, which, I think, will settle beyond a reasonable doubt, the fact that under certain circumstances, from the irritation produced by caries, and from other external causes, changes do occur within the structure of the dentine, which are due to vital action.

The first argument is so well expressed by Mr. C. S. Tomes, in presenting the *pros* and *cons* upon this subject, that I shall adopt his own words. He says: "In favor of the view that the dentinal fibrils become calcified, several arguments may be adduced; one is its *prima facie* probability. We know that slow progressive calcification does go on in the tubes long after the apparent completion of the dentine, and, seeing that the irritation of caries does unquestionably cause calcification to start afresh in the pulp, it seems very natural to suppose that it would have the same effect in dentinal tubes."

While it is doubtless true that secondary deposits are often formed upon the internal surface of the dentine in teeth when there does not appear to be any calcification of the contiguous fibrils, this fact would only prove that the irritation to which these terminal fibrils had been subjected, (which must be greater here than in remoter parts) had been so great as to overcome the resisting vital force in these cell processes, and to cause their ultimate destruction. But, when the stimulating influence has been less overpowering, but long continued, as, for example, in Stationary Caries, there are often found calcareous deposits both in the dentinal tubes and upon the internal surface of the dentine.

Now I have a single fact to present, such as I have nowhere seen mentioned in this connection, and which shows conclusively that irritation of the terminal fibres in the dentine does cause this calcification. In a case in practice, which struck me forcibly at the time, I saw some central and lateral incisors which had been extensively filed for the removal of caries when the person was 14 years of age, and 18 or 20 years before he came under my hands. I found, on examining these teeth, some slight points of decay—so slight indeed, that I felt at first doubtful as to the propriety of filling them. The patient, of his own accord often spoke of the sensitive condition in which these teeth had remained for several years after they had been thus filed. In preparing these cavities to be filled, I found the dentine of such a flinty hardness that, though I used the engine, I had great difficulty in forming them. You have all seen similar cases to this, and I mention it only because the unusual density of the dentine was here shown in a very marked degree.

Since the introduction of Dr. Arthur's method of forming spaces, and removing superficial decay, no fact has become more generally established than that the irritation produced by the removal of superficial dentine, causes the obliteration (in a greater or less degree) of the terminal dentinal tubes; and this is beyond question due to vital action, as really as are the calcareous deposits upon the inner surface of the dentine.

If the irritation caused by the use of the file, or by other mechanical means, is capable of causing the calcification of the fibrils, we must believe, in the absence of any other rational cause, that the irritation arising from caries, when found sufficient to induce calcification in that portion of the cells lying *within* the pulp cavity, might also affect in the same manner *that part* of the cells which lies *nearer* the source of irritation.

In closing this report—or essay if you please—I would offer my grateful acknowledgements to Dr. McQuillen, of Philadelphia, and Dr. Chase, of St. Louis, and also to Dr. Swain, of Chicago, who have kindly furnished me with histological specimens of rare value bearing upon this subject.

DISCUSSIONS.

Dr. Atkinson: I had hoped that a report of such importance as this would have caused the jumping to their feet of at least a dozen of the hard workers and close thinkers upon histology in this body. I wish to name some of the principles that seem to be overlooked, and also to suggest that we are laboring under great difficulty by endeavoring to wear the clothes of our histological childhood—that we are entrapped by the verbiage of this paper into thinking that chemical action is not vital action. That there is a difference we understand very well, but difference between the power that produces anything that is moved, if held different in kind, is a fallacy, and is clearly sufficient to make the conviction fasten itself upon every mind when the statement is simply made. If we know the *power* by which all the operations of the building and the taking down of all the bodies that we are acquainted with, we know that we all refer to that *energy*.

Now to make the distinction that is made in different degrees of the process of constructing bodies and of taking them down, is a great stumbling block. It is in the way of our clear comprehension of what is meant when we speak of that minor expression of vital action, which is called chemistry. In the way that is intended to be understood, I have no doubt it is perfectly true. We think we have said something very smart when we said that dentine and enamel were different tissues, and that they were operated by different powers or different energies. They both owe their production to calcification, that is to say consolidation of lime-salts. That consolidation of lime-salts, if it were free, would go on to a perfect consolidation, which would be crystalization, and anything short of that would not be exactly crystalization. But it would be consolidation in the irregular form of molecules. Reference has been made to learned gentlemen in Europe that we are very fond of following. Would to God that we followed them with our eyes open, and digested what they say, and left all that is innutritious alone, and

took all that is nutritious, going forward leaving the old work and coming to a higher thought. All bodies that we are acquainted with, originate in a uniform mass of bodies, known as "embryonal corpuscles." They ignore all the action of the osteoblasts; they take up and use the embryonal bodies, that are themselves made up of a preparation that holds lime within it so closely that there has been no chemical analysis short of incineration—short of direct burning, that has been able to make protoplasm give up its hold on the lime-salts. I refer to the calcoglobin—that is, bodies that are transparent in their character may have just such lime-salts in them, and have all the regularly arranged molecules of lime-salts held in solution of the albuminose that we call protoplasm, that circulates in the dentinal tubuli; and it makes no difference as to the weight, it is simply the arrangement. You can see that this is true of ice; when it is regularly arranged and crystalized all the way through in successive planes, with exactly the same degree of consolidation, it is perfectly transparent; but if you have the cross lines of frigirification, you find it has generally an opaque appearance. I want to emphasize this point that all the human embryonal bodies that we are aware of, have to come from a proteinaceous substance, that is, a homogeneous mass, unpronounced to any of our senses, only understood by a long and labored analysis, as being an admixture of the various elements by affinity; with simply different arrangements held within the minute mass of either normal or secondary dentine, as the case may be; and when we shall come to know more about these modes and methods, we shall stumble less and understand more clearly the different stages that are called rapid and slow caries or decay.

In the paper, caries is used to indicate some sort of an agency that has a specific duty to perform, and it operates in a certain way. It is simply the absence of the togetherness of the tooth—of that quantity of affinity that holds the parts in a normal relation to each other in the type that built it—that enables it to be remanded to what is called the domain of chemistry. There is no tooth that can stand against certain forms or modes of motion. Suppose they have stronger affinities for the elements in the tooth than the elements of the tooth have for each other? When anybody comes to court Susan a little better than Jimmie, to whom she was married, you may bet that Susan will go for him! What does this courting mean? It means the awakening of the latent energy that is in the substance from which we build any of the bodies. And as dentists, it is very fortunate that we have not to travel much out of the expression of crystalization in its various degrees when we deal with enamel and dentine. When we deal

with cement or with soft tissues—those that are called animal tissues—the work is more complicated and it is more difficult to see. But we forget that we must have the animalized basis out of which these calcific or mineralized products are produced before we could have these affinities awakened so that they could arrange themselves in the enamel rods and in the dentinal interspaces, leaving an uncalcified track that still continued to circulate the protoplasm, the nutrient material that holds lime salts together and has been known to break up into globular masses in consequence of the very substance that is here referred to (calcoglobin,) as making the clear zones or cones in the tooth with those that are less transparent and that depend upon the awakening of certain affinities in the atoms that constitute the molecular mass out of which the tissue is built.

We are talking very fine things when we are talking about the bonds of affinity, the power to unite atoms. If we had a whole month to discuss this question, and could have specimens before us, we would begin to be able to comprehend something about it, and we would then know why it is when we cut out a decayed place and fill it with some indestructable material or some substance that is not capable of being dissolved, and that would not destroy the life of the tissue, we would succeed in saving the tooth; and this knowledge lies at the foundation of our ability to diagnose what that ought to be. The reader of the report said he was in doubt whether he ought to attempt to fill the tooth, and when he came to excavate he found it—did he say "harder than enamel?" If he did not, I can tell him *I have*, repeatedly, and I presume if it were weighed it would have been found to have greater specific gravity.

Dr. Chase: Any one that has made a large number of microscopic specimens knows very well that the more dense the dentine is, the more it is calcified, the easier the edges of the specimens break away; and that is the reason why it is so hard to make specimens of enamel for the microscope; and if you have a specimen that is very highly calcified you will find the edge very ragged, having projections and indentations, in and out; but if you have specimens from a young tooth not highly calcified, the edges of your specimen as you work it down on the stone will be uniform, because it does not break away like glass, as it does when highly calcified; and, by the way, it looks like glass in making these specimens: I have observed a great many times where there has been decay, that there has been a hyaline appearance in the vicinity of the cavity, indicating a higher calcification of the dentinal tubes, as they run directly to the pulp; some-

times only on one side, and sometimes both sides. Invariably where I find this appearance I find a ragged appearance of the specimen, showing that it is highly calcified, and that is one way that I can tell whether a specimen is highly calcified or not—by the way it rubs down.

The author of the paper is correct when he says that vital action has a great deal to do with hardening the tissue to obstruct the progress of decay. I am sure that I have specimens, if I have not given them away, showing decisively a vital change *within* the dentine, among the dentinal tubes, where absorption was taking place from the *outside*. A year or two ago in the *Missouri Dental Journal* was engraved a specimen showing a conversion or change of dentinal tubes back into its original cells; a regular cellular structure mixed up with dentinal tubes undergoing metamorphosis.

Dr. Waters: I can confirm the statement of the last speaker in regard to the friability of the hard parts of the tooth and, also, the statement that has been made in regard to density or hardness of those parts that have been subjected to friction. One tooth I operated upon was from my own mouth, and I know something about the service that it has rendered me and the labor that has been thrown upon it. In that case an adjacent tooth was extracted some years ago and disclosed a discolored spot on the enamel. That spot at the time of the extraction of the first tooth was somewhat soft, but dark; the surface of the enamel appeared, however, to be continuous. The first tooth extracted was a bicuspid, the second a molar. Upon extracting the molar I made three sections through the crown. The first section, which included the whole crown and down through the buccal roots, had an unusual appearance in the roots, the crown itself showing radiation of the tubuli, but the roots showing no tubuli, whatever, and having merely a clear, honey-like appearance. There was an obliteration of all appearance of tubes. The second section, which passed through the discolored spot, when subjected to a twenty-fifth, also showed places dissolved away in the substance of the enamel, and quite a space between the enamel and the dentine, the dentine having evidently shrunk, and showing much more discoloration than the enamel; but the enamel itself was in this case very friable. The dentinal tubes were mainly obliterated—towards the pulp there were some traces of them. The third section, made through a dark point or rather enclosing a dark point on the palatal surface of the crown, presented an appearance unlike anything that I have ever seen. In the surface where the edges of the enamel dipped towards this little dark point, a fifth objective disclosed something which looked like a vegetable

mold, a fungoid body. The twenty fifth brought it out more distinctly and gave it the appearance which a piece of bread will give to the unassisted eye when it has laid in a fish tank for a little while, and got fungi growing upon it. The appearance was as though there were rows of small threads leading from it, and on the ends of those, little knobs, looking somewhat as the eggs of the golden-eyed lace-winged fly. She touches a limb with her ovipositor, from which she extrudes her eggs, attaches a little albumen and draws it out, and on the end of the thread leaves a little white egg; she will put down two or three dozen of these eggs in one spot. That is the appearance which these little points had when very highly magnified. On one side the appearance of Nasmyth's membrane is wanting; on the other side it was distinctly to be seen passing into the chamber of decay, which was entirely within the enamel. I found there a large number of bits, resembling some of the fungoids; some of them looked like bone-cells. They were very singular, and I have yet seen no one who has been able to determine their exact character; but, from the appearance of the enamel in the neighborhood, I suspect them to be of low vegetable origin, and that, in their development, they throw off carbonic acid. The appearance is precisely that which you see in the cavities of lime rocks, where the lime has been dissolved away by carbonic acid, and that is why I suppose them to be of vegetable origin.

Dr. Robertson: I wish to say a few words in illustration of what I regard the truth of the essay that we have heard; that is, that dentine that has vitality resists decay and forms new deposit. I wish to illustrate that by my own case. My right upper central incisor was imperfect in its formation. It was more than a year later in its development than its mate. Before half its crown was developed it proved to be decayed; black decay, extending entirely across the front of the tooth, nearly the 16th of an inch in width. The cutting edge of the enamel was perfect to the extent of nearly the 16th of an inch. Nature deposited new dentine there and filled the cavity. By long use the cutting edge has been worn off, and more than half of the new deposit of dentine, but there is enough left now for any one who wishes to examine. They will find that it is perfect, with the exception that there is a slight line where it could not unite with the enamel on the side worn away. It seems to me this is a definite and positive proof of the truth of that essay.

Dr. G. T. Barker: I desire to add my commendations of the essay as read, although dissenting from some of the conclusions. The authorities

on both sides were presented, so thus an opportunity is given to examine and weigh the arguments. Dr. Atkinson has called attention to the great fact that we must not attempt to divest chemical action from the vital action, which we see going on in the economy all through life. They are one and the same, differing not in kind, but only in degree.

I cannot fully endorse some of the remarks of Dr. Waters. in which he speaks of certain surprising phenomena, or rather, manifestations of dental histology, which he observed by means of the *twenty-fifth* objective, in the microscope. Every one who has had any experience with high power glasses, knows that we are apt to be deceived by aberrations of vision, etc., and it is necessary to receive the evidence, unless fully substantiated by other evidence, with extreme caution.

Dr. Judd: I have but a very few words to say upon this question. In regard to the paper, I think it is well written and well considered—that its points were well taken and well defended. In relation, however, to one or two points, I would say a word. It was stated in the paper that it was conceded generally that the dentinal tubuli, or the dentine, rather, was either formed by a secretion of the odontoblasts or by a deposition of calcareous matter within the odontoblasts. It seems that there are different opinions in regard to the histogenetic action in the formation of this structure. and that it has been narrowed down to these two points. I am inclined to think, from all the evidence that we have before us, that this tissue is formed by the deposition of calcareous matter within the cell; but I wish to qualify somewhat this word deposition. We have been accustomed to look upon this word as simply specifying a deposit without any action connected with what we have considered as a vital power. This is the sense in which it is generally used; and, if this is the sense in which it is used here. I shall beg leave to differ from those gentlemen who consider this deposition as entirely independent of any vital force, because I believe that to a certain extent the deposition of the earthy deposit within the cell is brought about by vital force.

In regard to the doctrine of dentine being a secretion of these odontoblasts. I will simply state that in the first place we have no evidence before us that the cells secrete at all. If we take this side of the question, we must commence with a supposition, and then we have got to build up our arguments by other suppositions, based upon the primary supposition,

which, to say the least of it, is an exceedingly loose way of reasoning. On that account I am led to reject that doctrine altogether, from what knowledge we have at the present time.

I want to say a word or two in regard to this matter of vital action and chemical action. Dr. Atkinson is always impressing upon us that there is no difference between vital action and chemical action except in degree. Now I want him to tell me the exact degree of force that is necessary to be exerted to make it a chemical action, and measure the degree of force, if he can, when it becomes a vital action. I think myself that he is not quite clear upon this subject. We are apt to get into a little deep water, all of us, in discussing these subjects. I do not think that this definition that Dr. Atkinson and Dr. Barker have given us will answer in every instance. I think there is something else besides degree; that there are some other conditions besides simple degree in action, or degree in force, I am fully confident.

Now that the manifestations of force may be different in many instances, where the difference is produced by the thing or object upon which the energy is expended, may certainly be true. We know this—for I shall persist in speaking of dead and of living matter---we know very well that the action of certain reagents upon living and dead matter is exceedingly different under similar circumstances. And if it is the medium through which the force is exerted which gives rise to a variety of manifestations, the variety is certainly due to something besides the difference in degree of force, for exert whatever degree of force you please upon a living being and it will not produce the same result as the same amount exerted upon that which is dead.

In regard to these light zones which were found near the margin of carious cavities, I think it is perfectly philosophical; it accords perfectly with what we do know of vital action and physological action to suppose that it is due to the very cause that Mr. John Tomes supposes it to be due to.

Dr. Atkinson: As I understood Dr. Waters, he was perfectly correct in his statement. Had I been present and witnessed all the preparation of his specimen so as to determine whether he had got some fungoid growth by carelessness into the interspaces of the enamel and dentine that he speaks of, I would be more competent to give an opinion. The appearances which he has so beautifully described are only to be seen

by high power, and we are not aware of anything but vegetable productions that assumes that form. It is but an articulated mass, and one of the most profound microscopists living, Heitzman, an enthusiast in this department, has described what I understand Dr. Waters to have described. But that it has any connection at all with the process that he was detailing as a process of retrograde metamorphosis in the enamel structure, I have not the least faith. He did not tell us that he had filed it all away, and could assert whether these interspaces in the enamel rods were not gaps left in the process of calcification during the formation of the enamel rods. He made another statement that to me is very heterodox; that it gave out carbonic acid, and that was one of the evidences of its being vegetable Well, he must have had some "crooked whiskey;" he got tangled in his evidence. Animal substance exhales carbonic acid, and inhales oxygen. There are few examples in the vegetable kingdom where they give off carbonic acid in the dark, but to take it as a rule is a misnomer and mistake. If the Doctor simply made a slip of the tongue he can correct himself about that, for we are speaking to young men who shall take our places when we can no longer have the privilege of coming head to head, and heart to heart, and give the results of our labors that were gathered from much toil and affliction, when we had nobody to help us and say "God bless you." The time is coming when we shall be awake, and our enthusiasm will rise, and we shall be so stirred as to get above the low conception that there is anything that is not alive, that there is anything to be seen that has not in it a modicum of energy—force; for even the atoms which never were created are original and absolute—hold within themselves bonds that, when they are awakened by the proper nearness and the passage of a current of energy which we call electricity, then they awake and unite in exact proportion to the bonds of chemical equivalency when that chemical mass has a certain number of bonds that are awakened by a definite number of bonds of the other atoms, and it is because of the number of these bonds that we are able to write the chemical formula. This point I wanted to make clear, and would be glad to show the degree, although we have no means of measuring the degree or what the bond of affinity is. You cannot weigh it, neither can you weigh an equilateral triangle; but when he gives the definition of the schools, that "it is a triangle with all the sides equal," it is simply a repetition of the first statement that it is an "equilateral triangle." What did I use this simile for? To show you it was not possible to measure how much was infinite, but that it is some measure, and that some is exactly equal to the other some that balances it. Ad—equation means balance of energy; balance of energy means expression of energy by what we call the forces, and

that is precisely what is awakened; should you try to annihilate any body, I don't care how "dead" or "damned" it is in your estimation, see if it don't wake up as one of the sixty-nine elements that we now know of, that go to make up the atoms. That is the evidence that there is no such thing as "dead matter."

Dr. Judd: I have only a single word to add, and that is in relation to the statement that Dr. Atkinson always insists upon. There does not seem to be so wide a difference in the way we think. I stated that I was not an advocate for a multiplicity of forces. We do not know about that: there may be one force, and there may be more, but what I do advocate is this, in regard to this word vital as connected with life. I stated before, that the difference that has given rise to the doctrine of a multiplicity of forces, may have arisen from the difference in their manifestations, and that the difference in their manifestations may have been produced by the substance through which they were manifested Suppose for instance for the sake of argument that we confess that there is but one force in nature, and that all of these conditions, as I said before, may have been produced by the different substances through which they are manifested.

Dr. Atkinson: One power, many forces.

Dr. Judd: Well, those two words are used by some authors as synonomous.

Dr. Atkinson: That is what I find fault with.

Dr. Judd: By others they are used---*power*, ability to produce effect; and *force*, the active influence which produces it. There is a difference of opinion as to how they should be used, but what I wanted to say was, there is, for instance, a force which we call a cohesive force, which draws the particles of matter together. We do not call that vital. It may be of the same force however, that produces vital action; but we speak of certain manifestations of force as vital action simply because by the word vital we communicate certain ideas to the minds of others connected with certain phenomena which we find in living beings, and which we find nowhere else. Then it simply comes to the question whether or not this is a word that is understood by the mass of those to whom we speak, for the purpose of language is to be understood, and language is proper or not proper as it accords to the general usage of the best scholars of the day. So you see

where I use vital, I use something beyond what the gentleman means when he speaks of cohesive force, designating force manifested in a certain way, and I hold it is perfectly right and proper to use the word in that way.

Dr. Waters: I wish to say that in regard to the case of which I spoke I did not venture to call the attention of any scientific body to it until I had presented it to quite a number of members of the dental profession, among others the microscopists of the Massachusetts Dental Society, and the Merrimac Valley Dental Society, both of whom pronounced it as something they had not before met with, and they did not venture to pass upon it. But as far as the appearances are concerned, they all seemed to see what I thought I saw. Having had their opinion, and seeing that they saw as I did, I carried these sections up to the Boston Society of Natural History, and presented them to the botanical section, where some of our best microscopists belong, and they all saw the same appearances. Some of them thought that part of the appearances were due to animal life and part to vegetable life.

I was aware that animals give off carbonic acid, and that vegetables, as a rule, do not; but I was also aware that the lower class of vegetables, particularly the fungoids, give off carbonic acid in great abundance, and it was to that class that I supposed they belonged.

Dr. Spalding: It has been said by some speakers that vital action had probably a great deal to do with these processes which have been described. I am prepared to go farther than that. I am prepared to say that vital action in my opinion not only has a great deal to do with these processes, but that it controls them. We have in the first place manifested in the physical body throughout its processes all the different forces of nature. We know what the physical forces are, and we know that they all have a certain effect, and produce certain results. We know that chemical force in itself is precisely the same whether it is in the human stomach or whether it is in the alembic of the chemists; but when it is in the human stomach it is in a different condition, for the reason that there is operative a vital force which dominates the chemical force. Vital force dominates all the physical forces wherever they manifest themselves throughout the entire domain of physiology. Hence although chemical forces act, they act only in subservience to the demands of vital energy in all its behests. They can act in no other way because they are subordinate to the special dominating

force. I might go on and illustrate this idea by a few examples, but it is unnecessary to mention the facts if you comprehend my position upon the subject.

A great deal has been said also about the living and the dead, and that this is dead and the other living. Let us see for a moment what life is. How can I give you a short definition of my idea of life? Of course there is no motion without the force that creates that motion; and wherever motion acts upon matter, there is a manifestation of the activity of that force. I would then say that life is matter in motion; that physical life, the life which pertains to physical nature, is matter in motion.

A MEMBER: Where does it get its motion?

DR. SPALDING: From the force that I have just been describing. All the forces are dominated by the special vital force which comes from above. There is a living force which builds and constructs; there is another force which takes down and disintegrates; but they are both equally forces. The force which destroys is no less a force in itself than the force which constructs; but it is operated in a different way of course. These seem to me to be the radical differences between the forces that we call living and those which we denominate dead. There must be words to express ideas, and we must have terms to designate whether we are talking about a building force or a disintegrating and destroying force. One we call a living and the other a dead force, but they are both forces.

DR. MCQUILLEN: This subject is one I feel a deep interest in, and which twenty odd years ago I devoted considerable attention to the microscopic examinations of, and placed on record in the DENTAL NEWS LETTER, Vols. 11 and 12, the result of those observations. I have not taken part in the discussion up to the present time because I desired to hear what others had to say on the subject; to ascertain whether the views then advanced were sound, based in fact, and logical; for I recognize that we are all liable to err, and no one more liable than myself. In listening to-day to the various views which have been advanced, it seems to me the opinions I presented on that occasion have been rather confirmed than disproved. I am inclined to regard this consolidation of the dentinal tubuli, or the deposits in the dentinal tubuli, as the result of vital action. We might with just as much propriety say that the changes which take place in the other portions of the osseous system (for the teeth are but part of the skeleton), are

not the result of vital action. There are certain diseased conditions of the bones (rickets), in early childhood where the bones are soft—have not a due supply of the inorganic constituents, and we know that in course of time, with a change in the constitution of the individual, these bones become hard. How is that effected? Is it by any other process than vital action? Again, in the osseous system, even in the most perfectly organized systems, changes take place, and bones that were perfect become softened during the period of utero-gestation on the part of females. And there is an old aphorism which has been looked upon as the mere utterance of a nurse,—and yet these vulgar aphorisms sometimes have truth as a foundation—"that for every child a mother bears she will lose a tooth." Here we have an illustration that not only is there a change in the condition of the skeleton, that the bones will soften, but that the teeth themselves are softened. There are those around me who can bear testimony to the fact that teeth which during the period of 17, 18, or 19 years of age, prior to the marriage of young women, have been hard, after marriage become exceedingly soft: due undoubtedly to this change taking place. Therefore I am disposed to regard the changed condition in the dentine which we speak of as consolidation of the dentinal tubuli, as the result of vital action.

I shall not enter into the hair splitting differences that are presented here between vital action and chemical action. Like my friend, Professor Judd, I think we should take language as we find it used by educated men, and regard certain words as meant to convey certain ideas. How does this change take place, however? It has been said here that there are two views in relation to the formation of dentine, as to whether there is a deposit of inorganic matter within the cells or whether it is a secretion from the cells. As has been very justly remarked, we cannot properly regard these cells as secretories. The odontoblasts in dentine and the osteoblasts in bone are tissue builders; they have a certain function to perform; they appropriate from the blood, materials that are subservient to the building up of the tissues, and any changes which may take place eventually, are effected through them. These odontoblasts are arranged around the outer portion of the dentinal pulp, as the membrana eboris. A theory has been advanced in explanation of the conversion of these odontoblasts into dentine wherein it is said that first there is calcification between the odontoblasts, forming what is denominated the inter-tubular structure, and then a conversion of the peripheral portion of the odontoblasts, constituting what is called the sheath of Neumann, and then the central portion remaining in a softened condition constitutes the dentinal fibrils. That these dentinal fibrils can undergo

change, that they can take up the inorganic constituents that are present in the blood, is as reasonable as that the odontoblasts themselves were originally capable of taking from the blood these constituents. I have in my possession an interesting specimen prepared by my friend Dr. Flagg some years ago, showing this peculiar condition of the dentine, which I shall be happy to show to the members, under the microscope, at such time as may be convenient for them.

VOLUNTEER ESSAY.

Is the Dental Pulp Essential to the Integrity of the Tooth Structure, or to the Continuance of the Teeth in the Mouth till Old Age?

By L. C. INGERSOLL.

I cannot discuss my subject wholly as an independent question. I shall treat it from a therapeutical as well as a physiological standpoint. Its therapeutical aspects present themselves to us in the light of the physiological relations of the pulp to the tooth structure, and the relations of that structure to the functions of life. The question involves, therefore, the practical merit of all pulp treatment, based as it is on our estimate of the intrinsic importance of the pulp. In proportion as we regard it ever and always chief of the dental tissues or lower in its relative importance, will be the persistency of our treatment to preserve it.

Early in the practice of dentistry, known exposure of the pulp was treated with devitalization of the organ. For half a century attempts have been made with varied results, to cover the exposure and restore the pulp physically and functionally to its normal condition. For a quarter of a century the preservation of the pulp as opposed to the earlier practice of devitalization, has gained the special and almost universal attention of the profession. It has employed the inventive genius, the studious research and the maturest thought of our best minds; it has been made the acme of professional skill, the criterion of professional standing. In the enthusiasm

of professional progress it has been pronounced "a crime" to extirpate the living pulp of a tooth. Rising to this high plane and *looking down* on inferior things, it may never have occurred to some that they *may* have occasion at some time, to return to the plane below for supplies.

Throwing aside the vast variety of materials which have been suggested and used as a mere mechanical covering of the opening into the pulp chamber, the profession seem to have rested with almost universal confidence in the use of oxychloride of zinc as superior to all other materials which have been proposed; not only because of its ready adaptability, but because of its supposed therapeutical effects. The profession, too, by a very large majority seem satisfied with the success of the treatment. Judging from the reports of cases, there is a marvelous uniformity in results, greater than in the case of most specifics, and as complete as can ever be reasonably hoped for through the fallible instrumentality of human judgment and experience. If then the *reported cases* carry with them no lingering doubts of their reliability, the evidence is overwhelming; and to esteem a pulp, in any condition of its life, of little importance, is being false to nature, and to extirpate a living pulp is most flagrant malpractice.

Let us take a moment's glance at the value of *reported cases*. In the excellent paper of Dr. Howe, read before the Odontological Society of New York City, he has collected reports of eight hundred and fifty-three cases treated by a number of operators, fifty-four of which cases proved failures; while the reports of a large number of dentists whose opinions he cited as favorable to the use of oxychloride, did not give the figures concerning the success of their practice. I have not gone to the authorities which Dr. Howe has cited to learn what remarks or explanations accompanied these reports, but I have this to say concerning reports of cases as *ordinarily given* to us in society meetings and in the journals: They do not, to my mind, bear the marks of reliability. I want to put the gentlemen who with so much confidence in their success, make these indefinite reports, on the witness stand and question them, that we may learn their diagnosis of the cases they have treated, and ourselves be able to judge of the probability of their fully understanding the pathological conditions.

Your cases are *reported* as representing a well marked and definite condition which you call *exposure of the pulp*, and your treatment of the cases is fixed and definite, viz., the use of *creosote and oxychloride of zinc*, and your success is defined simply by the word success. Now, sirs, allow me to ask, what do you mean by exposure? Do you regard *alike* the

opening as broad as the diameter of the pulp chamber and the opening as small as a pin-hole? And do you call that an *exposure* where the only opening is through the emptied tubes of the dentine, and only microscopic? Do you call that exposure which is made by excavating over a healthy pulp and that which is produced by the progress of decay, one and the same thing as regards treatment? And do you employ the one covering or capping material for all these different stages of approach to the pulp chamber, placing your cap directly upon the exposed face of the pulp, or upon the intervening dentine, as the case may be? And the pulp—is the condition of it always the same whether the exposure is great or small? Is the condition of it always the same whether caused by an excavator suddenly, or by the slow progress of decay? The treatment—is that the same, whether the exposure has been of brief or long continuance,—with creosote and oxychloride? Does every condition, whether it be irritation, determination of blood, congestion, or suppuration, succumb alike to your *one* treatment—the creosote bath and oxychloride? Do you *know* that the pulp will remain in a healthy state with an artificial covering—done up in a rag like a sore finger, or like the sore finger that it will *re*-form under the rag its own natural covering? Are you sure that secondary dentine will be formed after the peripheral cells have been obliterated as a result of the exposure? How long after the first indication of exposure can the pulp be treated with success? And what do you call success—the comfortable condition of the tooth for one month, for six months, one year, three years, or till old age? What are your tests of success? Is there no deception in cold water, ice, percussion and the drill? Are your patients so versed in pathological sensations as to report to you understandingly and without self-deception the twinges of experience that may follow the treatment of their teeth?

This is not all, but it seems to me that I have opened up the case sufficiently to show the absurdity of trusting to random reports made up of four terms—*exposure*, *creosote*, *oxychloride*, *success*. The desirability of the object to be gained makes an interested practitioner eager to catch at the first hint of successful treatment, especially when so simple, without consulting conditions and circumstances that might modify results. Thus did the ass carrying his burden of wool through a stream. When he saw his companion, the mule, having his burden of salt sensibly lightened by getting it wet, he bent down to dip his sack of wool in the water, but with quite a different result.

In the diagnosis of any case presented for treatment, we may approach many facts with considerable certainty; but there are in the treatment of

every case at least two unknown quantities—vitality and idiosyncrasy. With these in the dark, our practice must be empirical; and cases must vary in the results of treatment, vexing us with contradictions and logical absurdities. We need but a slight review of specifics and medical formulas to convince us of the unreliability of "cases" as commonly reported. Explosions of theories and accepted practice have followed each other in quick succession down the channel of the ages, chafed by the sharp touch of contrary opinions. Yet each in the period of its inaugurated success was substantiated by its list of reported cases—"most profitably numerous." I am constrained to believe with Sir Benjamin Brodie that "there are epidemics of opinions as well as of disease."

Edward Spencer in his paper on "Medical Fashions," among numerous points illustrated, pricks the bubble of *reported cases* with several examples. He mentions the case of one Dr. Spalding who in 1819 published a pamphlet in which he attempted to show that a decoction of the dried plant of the common *Virginia Skull-Cap* was an infallible preventive of hydrophobia, as well as a cure of the disease after attack. He cited the cases of eight hundred and fifty persons bitten, of whom only three were attacked, and these recovered. He claimed also to have used it with uniform success in the treatment of eleven hundred animals. But the mysterious disease rages still, and the skull-cap has "gone to the dogs;" not however to those that have hydrophobia. Not many years ago Dr. Fell discovered an infallible cure for cancer, found in use of *sanguinaria canadensis*—common blood-root. With his remedy he went to London and became so popular, rich and marvelously successful, that he was finally put in charge of the cancer ward at Guy's Hospital, where his whole system collapsed as signally as it culminated. It is fresh in the minds of many of us—and in the throats of some—that a celebrated doctor of New York introduced a method of treatment of throat and lung diseases by means of caustic introduced on a probang inside the glottis, and claimed to have performed this operation one hundred thousand times. He was indicted for manslaughter for one of his failures; and who has his probang now? His sucesses were very numerous, and for a time the profession near and far adopted his treatment.

Twenty years ago other treatment than the oxychloride of zinc for capping pulps was reported as successful, compared with the number of operators, as is the favorite treatment of to-day. The effort now so universal among the profession to save the dental pulp from death by disease is most

commendable; and our only fault seems to be in believing *too confidently* that we do it. I would not include all, for the experiments and tests of some who are cautious and guarded in the selection of their cases have been thorough enough, and have reached over a period of time sufficient to warrant a belief in the permanence of the vital condition of the pulp of a majority of the cases they have treated. But from my observation of the treatment of cases by myself and others, the majority of cases are failures in from eighteen months to three years. The early method of devitalization of the pulp *without extirpation* proved in many cases successful, with no unfavorable results appearing for years; while most cases would remain a reported "success" for a year or a year and a half, when abscess would ensue.

Probably a fair statement of the case as concerns the treatment of the dental pulp by all classes of practitioners is this: A large number of the cases *called* exposure of the pulp are cases of irritation caused by thermal changes or osmosis of oral fluids, without having caused inflammation of the pulp. In such condition the base of the cavity is extremely sensitive to the touch of an instrument, because of the thinness and elasticity of the plate of dentine still covering it—is sensitive also to cold water and to air. Another class which have been called cases of exposure of the pulp were cases of simple inflammation, and were readily relieved and the pulp restored to its normal action, by giving relief from such causes of irritation as I have named above. Another class of cases treated are those cases of *real* exposure caused by violence in mastication or by the work preparatory to filling, and brought under treatment without delay. There is no doubt that the three classes of cases named have been treated with the oxychloride capping with complete and permanent success. If only such cases as these were presented to us, cases that could be with a good degree of certainty known to be such as I have named, we could by careful manipulation, employing not only oxychloride of zinc, but any other material which has been proved by experimental tests to answer the conditions, no doubt reach a high average of success. But the pathological nomenclature of these *reported cases* covers with a single term all cases of exposure—the worst forms of exposure and those of long standing; and includes those cases where the pulp is undergoing the process of elementary destruction. In nearly every such case I believe that the oxychloride treatment only helps the pulp to die easy, and embalms it for a season after death.

I come now to the direct question—Is the dental pulp so essential to the integrity of the tooth structure when matured, and is the treatment of

it in all diseased conditions so simple and uniformly successful that deliberate extirpation is an unwarrantable practice? And, furthermore, does the continuance of the teeth in the mouth, comfortably and usefully, depend largely upon the functional support of a living pulp? To this double question, and to each of its parts I answer, no. I have already given my reasons for doubting the reported success of treatment based upon a high estimate of the intrinsic value of the pulp.

Let us now turn our attention to the integrity of the tooth structure as affected by the presence of the pulp. It has been stated and believed by many that vitality in the teeth protects them from decay. The analogy of inanimate nature and of the soft animal tissues is adduced in proof. It is well known that if the vitality of any portion of soft tissue terminates, the substance rapidly decomposes. But the law does not hold good concerning the hard tissues. When the English king, Edward III, died, a few weeks, or months at most, were sufficient to decompose all the devitalized soft tissues of his body. But the devitalized hard tissue of his teeth retained its integrity for more than three hundred years, when his remains were exhumed. If vitality is essential to protect the teeth from decay, the enamel, which is the most exposed and must first fall a prey to the wasting influence of decay, would, in the wise economy of nature, have been more vitally supported. Vitality in children's teeth has a wider area, and more formative and reparative energy than in adults' teeth, yet they decay more rapidly. Such facts are sufficient at least to create doubt, and a necessity for strong proof. Whatever foundation there may be for this theory, it probably has its strongest point in a single fact, viz.: When the progress of decay has been arrested by any accidental condition or applied remedy, by a vital process, the dental fibrils are calcified, and thereby the body of the tooth made more dense and better able to resist the influences producing decay.

The chief office of the pulp among the dental tissues, is that of being the formative organ of the dentine. To this work it gives up its life. In the performance of this function it gradually exterminates itself. Thus by a law of its own it *tends to self-extinction.* In advanced life, teeth are found with the pulp chamber and the root canals so wholly obliterated as to afford only the narrowest space as the grave of their former occupant. All that remains is the shriveled skin of the extinct pulp; and the walls crowd hard upon it. In studying the high importance of the dental pulp, bear in mind this tendency to diminution and self-obliteration. Having completed its formative work, the indications of nature are, that the pulp has little more

to do. In this view of the case the decisive question to settle is, at what period in life can it be said to have completed its work? When do its legitimate functions terminate, so that it becomes of little consequence whether it lives or dies?

There is a period of growth and development, and a period, no doubt, of maturity—when the human body stands complete in all its form and functions. The precise time when this period arrives, dating from conception or birth, will vary by months and years with different persons. It is assumed as a common average that from eighteen to twenty-one years are required to give physical completeness to the human body---the female maturing in less time than the male. Whether the time generally conceded be strictly correct or not, it is not material for us in the present discussion to pass judgment. So much of the formative work of the teeth is carried on before they emerge from the gum, that I think we may safely say that they become thoroughly mature for their functional work in ten years after their emergence---counting the same number of years for each tooth after the time of its emergence. I will quarrel with no one as to the absolute correctness of this estimate. The number of years required in any case will be estimated by the ability of the organ for the complete performance of function. The pulp at this period takes its rest. The enamel organ exhausted itself at an earlier period, and became extinct. The fact that enamel matures in hardness and brilliancy after the tooth has cut the gum, is, to my mind, no evidence of any remaining vitality in the sheaths that possibly may form the microscopic bond of union, laterally, of the enamel rods. The lime salts composing the enamel have such an affinity for the elements that load the atmosphere, that this cause alone is abundant explananation of the crystalline beauty which the enamel assumes after emergence from the gum.

If this view of the case, as concerns the waning functions of the pulp, seems unphilosophical---contrary to nature---I have but to refer you to the generative organs, that cease their function and take their long rest after the meridian of life; to the same organs also that *exist* in organic completeness, but never perform function through the entire period from puberty to meridian.

If I have rightly set forth the office work of the dental pulp and its relations to the other dental tissues, the profession have overestimated the importance of the organ in *mature teeth*, and have complicated their case

with more unmanageable disease of other tissues by too long continued efforts, in bad cases of exposure, to save the vitality of the pulp. The high standard of practice at present, requires me to conduct my diagnosis and decide upon the treatment of nearly every case with reference to saving the pulp alive, even to the preservation of remaining fragments of nerve in the root canals—to make even the worst cases a subject of continued experiment, and to be reconciled to death of the pulp only after, and as a result of, the failure of doubtful experiment—and this, because of its *intrinsic value to the hard structure.*

Viewing the case from the standpoint I have presented, *extirpation* comes earlier into the arena to compete with the well received practice of *pulp preservation.* And now, in the language of the law, there is a "change of venue," and a new issue too. The question is no longer the *preservation* of the *pulp* but the *preservation* of *the tooth*, and oxychloride treatment of the pulp as opposed to extirpation as a means of preserving the *tooth* in a comfortable and useful condition to old age.

Setting aside those cases of exposure where there is no established disease of the functions or structure of the pulp, as cases readily yielding to the "capping" treatment, all other cases come to us burdened with too formidable an array of doubts. to warrant the dentist in tampering long and risking much by pulp treatment, when so little is risked by pulp extirpation.

It is a well established fact that there are in the human organism, generally distributed, functional powers working at varying balance of each other for waste and supply of tissue—that worn-out tissue is being perpetually removed and new pabulum supplied to rebuild the waste. I believe it will be found that the teeth, that are an exceptional tissue in so many other particulars, are also exceptional in this. It is quite evident to my mind that the *enamel* is *not* subject to this law of waste and supply, and it is by no means an established fact that the *dentine* is subject to the law, except as pertains to its animal portion, which in a matured tooth is a very small proportion of its substance. The argument, therefore, for the preservation of the pulp, based upon its supposed value in replacement of lost tissue of the dentine, has too uncertain a foundation to carry conviction to the mind. Yet this is the strongest argument and the only one worthy of consideration that has been advanced for the preservation of the pulp. But after the pulp is dead, there can be no loss of dentinal tissue by absorption, hence no demand for replacement. The argument for the value of

the dental pulp in calcifying the dental fibrils after the maturity of the tooth structure, as explained in the former part of this paper, I have already inferentially answered.

The success of pulp extirpation consists in the *thoroughness* of the operation. The effort should be to remove every vestige of the devitalized tissue, even from the termini of the root canals. Should this for any cause be an impossibility, what remains should be dried of its watery portion, shriveled and embalmed. This cannot be done in a day; it takes time. Thorough work in extirpation requires very great patience and very skillful manipulation. Not what we may *wish* to do in conducting the operation of extirpation, but what we *can* do, is the dictate of sound judgment.

Therapeutical treatment is based upon our conception, not of physical forms but of the activities inhering in those forms and our estimate of their value to the organism. If in our therapeutics we have been led somewhat astray—though on the right side, yet *astray*—by overestimating the importance of the organ we have attempted to treat, and have often failed, we need not "mourn as they who have no hope," for there is hope still *for the tooth* in *extirpation* of the pulp. The cases of longevity and even of extreme age of pulpless teeth are so numerous that I need but to allude to the fact to stimulate your memories to recall them.

Henceforth let our watchword be THE SALVATION OF THE TEETH, not the salvation of the pulp.

DISCUSSIONS.

Dr: Rawls: The pulp, I contend, is necessary to the salvation of the entire internal structure of the tooth; and when we can have an entirety, surely it is better than a part. When we destroy any of the life-giving tissues of a tooth, there cannot exist the same chance of that tooth lasting as if it were an entirety. When we can save the pulp alive, and performing its function as it was intended it should do, it is much better than to cause its destruction; this for many reasons, and one of the principal reasons why we should, when there is a possible chance, endeavor to save this tissue alive is, that if we should resort to its destruction we must remove all that portion destroyed, check by antiseptics the decomposition of animal fluids contained within the dentine, and hermetically seal the cavity; this in very many cases cannot be accomplished, and if not so accomplished the results would not be of lasting success. When you protect an exposed pulp you are simply doing that which in case you destroy it, you purpose doing with the same tissue when it is severed at or near the apex of the root; and certainly if by any means you can save the entire pulp, with all its communications to the dentine, it is much better that this should be done; failing in this, you may try destroying and extirpating, and then if unsuccessful you may resort to extracting and replanting, and that too, with a probability of success every time, so far as my experience goes.

The paper states that the pulp was not intended to last longer than till a period when the filling up of the cavity might take place. I would ask how long does it take for nature to accomplish this? How many cases have been observed in which such results occurred, even in old age, and when it does take place, of what account are such teeth afterwards? Do you not find that after a patient has arrived at the age referred to, if calcareous

matter is thrown out, obliterating pulp cavity and nerve canals, there exists other signs of senility, such as absorption of the process and loosening of the teeth, such as would render them of hardly any consequence, instead of preserving them in the height of their glory and ready to perform the functions for which they were intended? You might as well say that the blood vessels, after having supplied the bones and muscles with everything that it was intended they should be supplied with, should then cease to perform their functions and leave the body to go in that condition without its usual life-giving resource. Again, with reference to capping pulps, it seems to me that the pathology of this organ has not been taken into sufficient consideration, that there have been no distinctions made between the different grades of inflammatory action which occur in diseases of the pulp; this I think should not be overlooked. One who understands how to care for an exposed pulp at all will understand how they should be treated; no matter what their condition be, he will know whether there is congestion or active inflammation, or whether there is suppuration or death of a portion, or of the entire nerve tissue, and I believe, from my knowledge of the intelligence of dentists in the United States, that they, as a rule, are pretty thoroughly posted in regard to this subject; the trouble is, they do not get the benefit of their knowledge, or give their patient the benefit of it by always putting it into practice.

There are some good points in the paper, and it is well enough they receive proper consideration, but in reference to the other points, I think the essayist has so presented them that a wrong inference might readily be drawn, thereby misleading many at least of the younger members of the profession. There is no doubt in the proposition that dentine should receive life and sustain its integrity through, and by the aid of, the pulp tissue, and circulating nutrient fluids therein contained, but there is doubt concerning the proposition that there exists no more use for the pulp and its ramifications after the tooth has once been completed in structural entirety. Again I repeat it, that when the circulation of nutrient material has been cut off by destruction of the pulp, the dentine will surely tend to disintegration, and this is wherein one of the difficulties exists in our efforts to save a tooth after the pulp has been destroyed and removed. If we could fill every root so as to hermetically seal it with some antiseptic substance which would neutralize or counteract the force tending naturally to disintegration, it would indeed be well, but this we cannot very often accomplish; but if life still remains in the pulp, the prospect for its restoration to health at the

point of exposure will be equal to, if not better than the probability of restoring to health the nerve tissues when they are severed at the apex of the root.

Dr. Barker: I cannot help differing from the conclusions presented by the essayist in his paper. I consider that its tendency is toward retrograde practice. In the successful preservation of the life of the exposed pulp is involved the highest expression of conservative dentistry, although it is no doubt true, as asserted by the essayist, that too great success has been claimed by some enthusiastic practitioners; but even failures are not always due to errors of judgment, as it is a well established fact that some localities are more favorable than others; in Philadelphia, for instance, my experience and also that of several of my professional friends, does not show a favorable proportion of successful results as compared with the number of pulps capped. This result is no argument against the practice; for non-success is doubtless due to either atmospheric or climatic influences, or it may possibly be due to some agent in our drinking water, which may by catalysis, modify the nutrient functions and arrest the development of the healthy odontoblasts.

Testimony that is unimpeachable proves to us that capping of pulps is generally successful when discrimination is used, in almost any locality, and while such evidence is produced, it is sheer folly to argue against a practice because in some locality it does not answer every expectation. If I understood the essayist correctly, he contended that the principal if not the whole duty of the pulp was ended after it had remained ten years in the tooth. To this position I take exception, and say that the function of the pulp should continue as long as the life of the individual. Everyone of any experience, has seen the structure of teeth modified at all ages by, and through the influence of some systemic disturbance. No better illustration of this can be given than that change which takes place in the teeth after convalescence from typhoid fever; for months after, their structure will be soft, with marked evidence of absence of calcareous elements, but under the influence of favorable circumstances and improvement of nutrition, the teeth will become hard and dense—the lime salts being restored through the medium of the living pulps. As another reason for the preservation of the pulp under every circumstance, when possible, may be instanced the consolidation of the teeth, as one of the results of advancing age, thus preventing and in many cases arresting, carious action. It is a well established fact

that after devitalization and removal of the pulp, teeth are more liable to become diseased than they were before such treatment; and it may be well to inquire why this is so, and to what it is due.

An examination of other duplex organs when in a pathological condition will furnish us with more or less instruction. Take for instance the lungs or the kidneys, and when from accident or disease one cannot perform its proper function, the one remaining will act vicariously, will increase in size and functional activity, but under slight unfavorable influences disease is established in the organ, the part never being in a physiological, but always in a pathological condition. The same action is seen after the destruction and removal of the pulp, for then capillary vessels of the peridontium are increased in size and number, and a more rapid circulation is the result, a modified condition of hyperæmia being established. This action is induced in consequence of the vicarious action, the blood supply to the tooth being only furnished by the investing membrane, and, as in the other parts, any slight unfavorable influence will readily establish a disease in that tissue.

The essayist has adverted with some bitterness to the use of carbolic acid by those who cap pulps and attempt to preserve them alive. An examination of the reasons for the use of carbolic acid, either alone or in combination with any of the essential oils, for all have been found equally effective, will establish the fact that any agent which combines the qualities (topically), of anodyne and protective, will be advantageous, and in carbolic acid these are decidedly prominent; it is also a gentle stimulant, and when judiciously applied will favor sufficient irritation in the pulp for the elaboration of the healthy odontoblasts, and without some irritation there would be no activity of cell elements, without which restoration could not occur. From conversation with many who had had failures in capping pulps, I feel satisfied that sufficient care was not extended in selecting the comparatively healthy to operate upon, for no favorable results could be expected unless the patient is of such a diathesis as to favor physiological rather than pathological action.

Dr. Sturgiss: Dr. Ingersoll will have to defend himself if some of us do not do it for him. I think, in the first place, that his paper is misconstrued, I do not know how willfully or maliciously. There is no question but that this paper is a practical one for the locality of Keokuk, and would probably be for Philadelphia if they knew how to apply its doctrines. I was astonished at my brother when he came here with his thermal changes,

and his locality, and his water. Dr. Ingersoll, I think, can do in Philadelphia what he can do in Keokuk. I do not wish to take a radical view of this paper; I think the paper should be discussed upon its merits. That Dr. Ingersoll, or anybody else, can save all the teeth that have exposed pulps, under the different degrees of inflammation, I suppose will be admitted is not true. One gentleman says that one of the last resorts is to extract and replant when there is any danger. There is danger in that in Illinois—maybe not in Kentucky. We sometimes extract, fill and replace the tooth; I have done it in a good many cases, but some of these I have lost. All have been done with apparently the same care, and in the same locality, and under the same thermal changes, longitude and latitude, but I have lost some and saved some. We may as well come down to this simple fact, that all exposed pulps cannot be saved. I have been successful in capping nerves, but in these cases the inflammation had extended but very slightly—probably all the inflammation was what I had occasioned myself with the excavator. If I cannot save the pulp in a healthy condition, I will devitalize and remove it, and try to save the tooth in that way. I agree, however, with the last gentleman, that it is essential to keep the nerve alive, if it can be restored to its normal condition of health.

Dr. Robertson: I do not agree with the position taken in the essay, in the statement that when a tooth is once fully developed the pulp has no further office or function. The pulp supplies the crown of the tooth with blood and vitality. The nourishment of the root of the tooth is supplied through its periosteum. Nature abhors a useless thing just as much as it does a vacuum; and we all know that when the crowns of the teeth are destroyed and the roots become useless, nature casts them away sooner or later. But, if by any means you restore the crowns to such roots, so that they may have proper exercise, they will remain in a healthy condition for an indefinite length of time.

Dr. Ingersoll: I am very sorry that I was not able to make myself so well understood that a member of this body should even have supposed that I came here to impose upon this association a paper which was utterly unworthy of its consideration. He went further and seemed to assert in his remarks that I opposed the use of oxychloride of zinc and creasote. I said nothing whatever against the use of these in suitable cases. I have used them with great success in cases in which I deemed them appropriate. Now to make this matter a little more plain, let me state, so that we may

come to the point of discussion intelligently, what I meant. The first point of discussion is just this, that we have overestimated the value of the pulp among the tissues of the teeth. Go back to the history of the treatment of exposed pulps 25 years, to the day when everybody devitalized exposed pulps. You will find teeth, in the mouths of our patients, doing service that have been pulpless from twenty to forty years.

That we have overestimated the value of the pulp is evinced by the great eagerness of the profession to find some method by which we may preserve all pulps alive; as though the pulp is as necessary at all periods in life as the dentine. We have striven to save the pulp because we have been accustomed to esteem it essential to the preservation of the teeth. The gentleman from Philadelphia says they are not generally successful in capping pulps in his city. What do you do when you fail?

Dr. Barker: If we have trouble we have to devitalize.

Dr. Ingersoll: That is the *very point* I made, and those are the kind of cases to which my paper referred, that should be devitalized at once. I admitted the use of oxychloride of zinc and creasote in three classes of cases which are *usually termed exposure.* When you come to a bad case that has been for two or three or four weeks or a year in a state of violent inflammation, giving constant pain and threatening suppuration, I would call it a pretty bad case. But the doctrine taught is to cap with oxychloride of zinc. Now my doctrine comes right in to meet such a case—do not tamper too long with that pulp and cap it with oxychloride of zinc. Devitalize it. Gentlemen say you must not devitalize a pulp, because it has functional service to perform to the end of life. It won't perform that service in this condition. It is tending slowly to destruction. Its functional power is gone, it barely maintains a morbid existence. You are much more likely by devitalizing such pulps, to preserve the teeth as servicable members, than, by capping, to allow them to die a spontaneous death, and leave a putrid mass in the pulp cavity and in the canal of the root. It is a question for determination in every bad case whether you will attempt a doubtful practice or that which is a certain one.

We have prized the pulp too highly. I find teeth that I treated in this way eighteen or twenty years ago in a good, sound condition today.

With regard to the pulp, its importance and its office, we acknowledge that it is the formative organ of the dentine, the chief substance of the

tooth. Having performed its work and developed a tooth structure capable for the complete performance of function, it has but little more to do. Thereafter it renders an inferior service in the vital support of the tooth. Pulpless teeth do not decay, as many suppose, with increased rapidity. They remain in the mouth—they testify to the truth. You will find pulpless teeth all over the country doing good service. The main point is, *after the tooth has come to its maturity*, to protect the peridentium from disease. The intimate relation between the peridentium and the pulp is such that whatever operates to disturb the pulp is felt in the surroundings of the root. You endanger the life of the peridentium and you are endangering the permanence of the tooth in the jaw.

Dr. Barker: What is the objection to making the attempt? How are you going to do any more injury than by making the arsenical application?

Dr. Ingersoll: The objection is to be found in the thousand and one failures we have in this practice. We fail in more cases in the attempt to save teeth by capping, than we do by extirpation. We endanger the permanence of the tooth by attempting to cap a long exposed pulp, and thus complicate the case with alveolar disease, resulting perhaps in abscess, whereas on the other hand we should by a careful extirpation avoid these dangers, and gain complete control over the disease.

Dr Allport: I remember that some thirty years ago when I commenced the practice of dentistry, I read a very interesting paper from Dr. Dunning, of New York, entitled, as nearly as I can remember, "The possibility or practicability of devitalizing the dental pulp and saving the tooth." At that time it was the general practice to extract all teeth in which the pulp had been exposed. And although Drs. Dunning and Maynard had succeeded in filling the roots of teeth with gold after the pulps had been removed, and saving them, the doctrine advanced was met with a general demurrer on the part of the profession. Since that time important changes and improvements have been made in this branch of practice. The advisability of the practice then so seriously questioned was soon fully demonstrated, and the practice was soon adopted by most of our leading operators, and thousands and probably millions of teeth have been saved in that way.

After this for the second time came up the question as to whether it was possible or practicable to save the pulps of teeth alive after they had become exposed. Many doubted it, and laughed at the idea, but success has been so frequently met with in the attempt, that but few of our first-class practitioners seldom destroy the life of recently exposed healthy pulps without an effort to save them. Still our friend from Philadelphia says that the practice has not met with success in that city, and assigns climatic reasons for the failure. That he is right as to the non-success of the practice there, is not for me to question, for surely he ought to know better than I. But that the sole reason of the failure is climatic, may admit of a doubt. As I did not have the pleasure of hearing Dr. Ingersoll's paper read, I am not quite sure that I have a clear understanding as to the ideas advanced in it; still, I infer from the discussion, that he is of the opinion that too much importance is in some cases attached to saving the tooth pulp alive. Just what his reasons are for this, and in what cases he would not save the vitality of the pulp, I do not fully understand. Still I agree with him that there are cases in which the importance of saving the vitality of this organ has been over-estimated. Now, while no one can advocate more strongly than I have, and do, the importance of saving the dental pulp alive when it can be done, and at the same time kept in a healthy condition, observation has taught me that living pulps do not always perform their natural functions, and when they do not, they cease to be healthy organs, and are more apt to become a nuisance than a benefit. In such cases, to avoid subsequent trouble, they should be removed We have all been in the habit of thinking that so long as the pulp retained its vitality, it as a matter of course performed its proper functions—maintained the circulation and the vitality throughout the dentine, and kept up a continual deposit of new dentinal material. But this, I am satisfied, is not true; for in many cases I have found the pulp living, and the dentine dead—as much so as if the pulp had been removed. In this condition the pulp has ceased to perform its proper functions, and is useless. To this proposition the question will naturally be asked, How is this condition—a living pulp, and dead dentine—brought about? That I can answer this question correctly, I am not quite sure. Still, I will, in a few words, do the best I can. I believe it is the generally accepted doctrine, at the present time, that the death of the pulp results from irritation, inflammation, congestion, and ultimate strangulation. We all agree that the dentine derives its life through the pulp, and we have been in the habit of believing that vitality in the dentine is maintained so long as the pulp remains alive. But I am led to believe that this idea is not correct—that it frequently

happens that the dentine in part, or in whole, dies, the pulp still retaining its vitality. While it may happen that the dentinal fibres may become highly inflamed, and portions of them die, without greatly affecting the condition of the pulp, it may be a question whether a high state of inflammation in the pulp can exist without seriously affecting and endangering the life of the dentinal fibres from strangulation, the inflammation in the pulp being subsequently reduced, and vitality in that organ retained, with its functions destroyed; a pathological rather than a physiological condition of the organ is thereafter maintained.

In practice we frequently meet with teeth which, from their peculiarly blue or opaque appearance, lead us, at first sight, to diagnose them as dead teeth, and we open into them expecting to find a devitalized pulp, but all of a sudden the patient apprises us that we have struck life. Upon examination we find that the dentine is entirely free from sensibility, and is in a part, or the whole of its structure, as dead as if the pulp had been removed. If the entire dentine is dead, the pulp is useless, and from its pathological condition, is liable at any time to give serious trouble, and it is far better practice to remove it at once, and fill the root canal with gold, than to fill the crown, and leave within the tooth a worse than useless organ.

Dr. Allen: There is not so much difference of opinion, I find, in listening to the various speakers, after all. They all arrive at the same conclusion, but express themselves a little differently. One point should be kept in view: we should take into consideration, in the first place, the constitutional diathesis of the patient, then examine the condition of the tooth to see whether the pulp is badly, or only slightly exposed. A successful course of treatment may be employed in the one case, and the same course of treatment in another will fail. The difference is in the nature of the case that presents itself. Secondly, every operator should "mix his brains with his work" all the way through, like Opie; we should investigate closely, and diagnose carefully.

Dr. Atkinson: I am pained, and I am pleased. I am pained to see men of broad intelligence not looking the ground wholly over, so as to clearly investigate all its departments. I am pleased to see that any progress has been made. I am also pained to see that some, who did run well for a season, are now crawfishing, as we say. They are going backwards because they have lost their enthusiasm to get hold of the foundation principles that enable them to diagnose the case properly, as has been said

by the last speaker; when they have accomplished that, then a very small degree of intelligence and ingenuity will dictate how to apply the remedies that may be successful.

It is no matter what a man's "experience" is. If anybody, that has the humility and opportunity, will come to my office, I will take the pains to get a tooth and show that when you split it open you can draw the fibrils out of the dentinal canals so that they will hang there, like little whips, just the same as you can disintegrate a bit of baleen of the whale. That is the type from which the human tooth learned how to do it.

The paper just read I wish to endorse in all the points I do not find fault with. It is folly for us to get up and kiss each other for the beautiful things that we say when we are all so lovely that we do not find a hook upon which to hang an objection. The point is this: that the ruminantia or cud-chewing animals have that kind of dentinal deposit that is nominated secondary or supplemental dentine, that does deposit regularly all the way, lessening the size of the pulp chamber, until it comes up to the end of the root, leaving the rest as solid as any other part of it is—a little more solid than the other part is—because in this process of calcification the calcific activity is so much more rapid immediately at the mouths of the dentinal tubes, that they are without uncalcified fibrillæ all the way out to the interzonal space, like a solid piece of lime rock, with a very few little tracks of uncalcified material.

It is said that we have made too much of saving the pulp alive. Would it not be more modest to say that we have made too little of knowing how to treat a pulp when it was in a pathological state? Would it not be well for us to investigate a little, before we do that which we cannot undo? That is the great thing! We may afterwards be illuminated, and then we shall say, "Out, damned spot!" to the uncomfortable recollection of our ignorance, but the "damned spot" wont "out," wash it ever so much. We had better enter a caveat against rushing in where angels fear to tread, in matters that we are either too lazy, or too much befogged, to make the investigation that shall make us masters of the situation; to know what we are talking about when we talk about nutrition of a pulp, dentine, or enamel; for the very moment we say that the pulp is of no use to the crown of the tooth, we acknowledge that there is some sort of nutrition that goes on even in the enamel. I want to ask if any of you have ever seen a filling of gold, that had been inserted into the pulp chamber to restore

the contour of the tooth, stand alone without any supporting walls of enamel or dentine, and for a term of ten or fifteen years render good service as a grinder? Has anybody seen such a case as that? If so, they will very naturally inquire, how is it that although well protected by a filling sufficient to stand for a term of ten or fifteen years, the dentine has crumbled away from around it? Does that sound like dentine, in a devitalized tooth, standing twenty, thirty, or forty years?

Leave the pulps in the roots of the tooth, if you care about the success and comfort of the operation! This is a sugar stick of mine, and it is so interesting to me, that I know it ought to be interesting to any man that dares to touch this sacred casket that contains the living man; that we shall not send him to his account in such a crippled condition that he cannot make the sign of recognition when he enters the gate, and has to be sent back to be patched up and remodeled, so that he can come in, in a shape to be recognized on the other side. That is the reason why I am down on fractional men; these men are not aware of how much mischief they are doing: There is no secondary product in the cavity of decay, however much we may hear about fillings coming out after they have been well put in, and leaving a polished surface. We must put our foot on such doctrines, when there are little ones near that may be led astray.

Dr. Noel: I want to ask Dr. Atkinson how it is that the fragment of a pulp in the root of a tooth can have any influence towards preserving the crown from decay, or what service it is going to render in preserving that tooth for service late in life?

Dr. Atkinson: I will answer the question as well as I can, if I understand what it is. It is like almost all the questions that shrewd men put to men whom they wish to entangle, mixing truth with perfect nonsense, and making the latter an equal factor in the manufacture of a complex question. The biggest lie that can be uttered is a half truth. There is no lie that is not of the truth. The object is to secure the nutrient activity of the enamel from the point where it is furnished with pabulum by the dentinal fibrils that constitute the nourishing part of the dentine, from there to the end, and a more important thing to secure the healthful circulation about the end of the root, so that there shall be no incipient abscess formed; and, with a great big emphasis, *preserve alive* the terminal ends of the vessels that supply blood to the nerve that comes from the branches of

the superior or inferior maxillary nerve, as the case may be, to keep up the neural activity that is essential to the vascular activity. Every time you destroy the nerve of a part you have paralysis and atrophy of the balance.

Dr. Allport: I have repeatedly seen teeth abscessed while the pulp was alive. I had one in the mouth of one of my own boys, which I showed to Drs. Dean and Cushing. I afterward destroyed the pulp and filled the root. I had one case where I put a large crown filling in a lower molar tooth, one fang of which subsequently became abscessed, and on drilling through the filling, I found the pulp alive. This I also showed to Dr. Dean. I subsequently destroyed the pulp and filled the roots. I could refer to many other similar cases, confirmatory of the idea I have advanced, but I mentioned these because they happened to be cases I have shown to others.

Dr. Crouse: I want to add my testimony in favor of saving the life of all pulps that it is possible to save. While listening to Dr. Ingersoll's paper, I was surprised at the supposed opposition there taken to the practice of capping exposed pulps. It seemed to me that the writer was almost entirely opposed to the practice; but his remarks on the floor would indicate that he does cap pulps, and that his practice, in this respect, was not very different from that of other men who act rationally in this matter; the difference being that he does not call a pulp exposed, that I should, or that is generally called an exposure. But one only hearing his paper, would, I think, get the impression that the author did not believe in trying to save the pulp when once exposed, either because it had performed its mision and was of no further use, or else when once exposed a pulp could not be saved. From his remarks I should say his practice was not very different from mine, and I cap all freshly exposed pulps, and all pulps that seem to be in a healthy condition, rather than to devitalize them. We take some chances in either practice. Some of the pulps die under the caps, but even then the teeth generally remain in a comfortable condition, and without material change of color. A small per cent. will require after treatment. The same is true, but to a greater extent, of teeth that have had the pulp devitalized and the roots filled; some of them will abscess, and a large per cent. will discolor.

I wished more particularly to speak of the case of Dr. Allport's, in which there was live pulps and an abscess at the end of the root. It is my

opinion that he mistakes the condition there—that is, of a live pulp. It is something else; it is a filling up of the pulp cavity with something differing from a normal pulp; an enlargement of blood vessels, or an extension of some tissues that have some sensation in them, but not a pulp in a healthy condition by any means. I have seen those things frequently myself in my practice, but I have the first time to see an alveolar abscess with a healthy pulp in the same root.

Dr. Rehwinkel: In listening to this discussion it seems that the tendency is to over-do. The danger now in our profession seems to be from a tendency to carry certain methods to the extreme. I had supposed that the point was long ago settled, that simple exposure should be protected, and that no attempt should be made to destroy a pulp of that kind. This is a condition of things that scarcely needs any argument in its favor. I think, as a matter of course, that every intelligent practitioner will run the risk of trying to save such pulps alive.

If we go to the second stage of exposed pulps, everything depends upon the proper diagnosis—not only as to the *extent* of exposure of the pulp and its pathological condition, but also upon a correct estimate of the capabilities of the recuperative powers. If it were possible always to perfectly understand the condition of the exposed tissue, and could we foresee how much nature would co-operate with us, we should be far less embarrassed as to the mode of procedure. It is proper, however, even in cases of that kind, to make every effort to save the life of the pulp. Through error in recognizing the extent of disease of the exposed tooth pulp, we may in our attempts to save, set up such an amount of irritation that death from strangulation may ensue; or else, the pulps may be quieted for the time being, but die at a subsequent period.

I believe that oxychloride of zinc is one of the most treacherous materials which we can use for the protection of pulps. There is a peculiarity about it which seems to be lost sight of. It does not kill like an executioner, but like a garroter. It is an assassin in the dark, leaving behind no convicting evidence of his work. I have often seen teeth which had been treated with oxychloride of zinc by operators whose names, even, gave confidence and assurance that the pulp was all right, and on commencing work with the belief that I had a live tooth to deal with, have been disappointed in finding a pulpless one. When oxychloride of zinc is used in cases of exposure, it may be a long time before there is any manifestation of trouble, and yet at no time is it reliable. If the root canals are closed so

thoroughly that no fluids can enter, it is all right, otherwise trouble will surely follow. I think it is a barbarous practice to extirpate the living pulp. I never do it under any circumstances, while we have other means to accomplish the desired object without pain. There is a great deal in the paper to which I subscribe, though in some respects it is, perhaps, a little overdrawn, and liable to be misconstrued.

Dr. Morgan: I consider the paper very skilfully drawn, but there is a charge, by implication, upon the profession of pretending to do what they do not do; a charge, by implication, that the profession are in the habit of saying that they protect pulps and save them when the pulps are not exposed, and in his classification, out of the three cases that are said to be exposed, two are of a class where there is no real exposure; and he leaves the impression upon the mind of the hearer that members of the profession are in the habit of practicing this sort of deception. I think better of my professional brethren than that, and I do not think the charge well founded.

Dr. Ingersoll: Any imputation of that sort was foreign to my intent. I was simply mentioning it as a fact that they were performing this operation of capping what they called, and supposed were, exposed pulps, which as a matter of fact, could not be rightfully considered in that category. It was understood that they had accomplished something which, in fact and in reality, they had not.

Dr. Morgan: That makes the matter worse than it was before; a charge of ignorance—that they, the dentists, are not capable of examining and telling whether the nerve is exposed or not. Where there is extreme sensitiveness, without making a thorough examination they are so slovenly that they go on and fill a tooth and declare the nerve exposed when it is not. I think that part of the paper should be a little corrected before it goes to the world.

There is another point with regard to those cases where abscess occurs and there is a live pulp. That might occur in a tooth that had more than two roots. An abscess might occur on one of them. There might be a live pulp extending clear up into the pulp chamber, but if the abscess covers the point of the root, it is dead to a moral certainty. An abscess never occurs until there is that amount of inflammation which would cause strangulation of the pulp, and consequently its death.

Dr. Allport presents a case where the crown of the tooth is dark and where there is a live pulp, and asks what is the cause of this appearance. There may be a portion of the crown of a tooth devitalized without the entire crown being so devitalized, and it may have that discoloration; in other words, when excavating upon the grinding surface of the tooth, in cutting in, you may cut across the dentinal tubuli, thereby destroying the circulation in the enamel. A large portion of the crown may be devitalized while the pulp is still living, because the communication between the pulp, the dentine and enamel is cut off; for, the very moment that is done, disorganization begins, and, in the course of time, there will be a breaking down of its structure.

One other point: gentlemen have said here that we over-estimate the value of a pulp, consequently the value of its vitality. How do you determine that value? I stand here to say that I care not what the estimate may be, it is never an over-estimate, because it is life. It is that which you may take, but which you cannot restore. (Applause.)

Dr. Noyes: We need not stop to question too closely as to just exactly *how much* the tooth pulp is worth, since the undoubted fact that it is worth *saving* whenever possible furnishes us a sufficient guide for practice.

Dr. McDonald: While there are many good things in Dr. Ingersoll's paper, there are other things suggested that may lead "the infants" of Dr. Atkinson astray. When he makes a claim that we have over-estimated the value of the dental pulp, I have to enter my protest. I have treated a great many exposed pulps, and have met with a fair degree of success, and with some failures. Is there any dentist here who never meets with a failure in any department of his practice? My idea of the treatment of a tooth is this: if we have a pulp exposed, attempt to save it, and if we fail, let us endeavor to learn of some man who knows more than we do, how to save more of them; then if we fail to save the pulp, we can extirpate it. My friend says we shall have an abscess. Cure the abscess. Any-one who understands dentistry as he ought to, can cure an abscess as well as extirpate a pulp. I advise no man here, after hearing the discussion of this paper, to go home with the idea that he has a license to extirpate every pulp he meets with. It is our duty to save every pulp we can, and if we sometimes fail, try to improve by that failure. If a man tells me that he can perform a certain operation in dentistry that I have failed in, my idea is not to say it cannot be done, but I take the ground that there is something, which may appear very simple when properly understood, which I do not know about, and I am going to find that out.

DR. NICHOLS: I, too, have a great solicitude about young men, as well as the gentleman who has just preceded me, and I would hate very much to have a young man go out from this meeting and *indiscriminately* cap pulps with the expectation that that was going to be good practice, because I know from my experience and from the evidence in my own daily practice that he would be following a most pernicious course. All should exercise constant judgment. The usefulness of the pulp depends on its healthy condition; if that is impaired it should be removed, and the work in the roots should be done thoroughly; and I am willing to go on the record for saying that the tooth that has had a pulp extirpated properly, and has had the roots filled properly, may remain useful a life-time. I care not about "disintegration," nor the discussion of fine theoretical points; what I know in regard to this matter comes from observations in my practice, and I have observed conscientiously. There may be a question between my ability to observe, and the ability of some one else. It has been thrown out here. two or three times this afternoon, that certain other parties lacked the ability to observe. Perhaps they do, but when they have observed they will draw their own conclusions, and they will base their practice upon those conclusions. My practice, based upon my own conclusions is, that when a pulp has been long exposed, devitalize it at once. I think that is the only good practice. *If we know that it is useless, it should be taken out.* As Dr. Ingersoll says very truly, it is our duty to preserve the tooth when it is a question between the tooth and the pulp. Attempting to save the pulp in certain conditions, we shall inevitably destroy the usefulness of the tooth. Dr. Allport's practice, I believe, as he enunciated it here to-day, to be the soundest that has been enunciated on this floor; and although I revere and feel very much indebted to our friend Atkinson, I certainly must go on the record against him as to the indiscriminate attempt to preserve the pulp under all circumstances. We should not destroy pulps under all circumstances, nor can we preserve them under all circumstances. We must use discrimination, and do that which appears to us best.

DR. MCDONALD: The gentleman who has just left the floor hopes the young men will not go away from here and indiscriminately practice the capping of exposed pulps. The whole discussion ignores the fact that if we are not successful in saving the pulp, our chances are not lessened for saving the tooth. I hope that every young man on returning to his home will endeavor to save every pulp alive, knowing that if he fails in this he can resort to extirpation.

REPORT ON PHYSIOLOGY.

By J. N. FARRAR, of the Committee.

The Importance of Direct Sunlight in the Operating Room.*

At the last meeting of the American Dental Association Dr. A. H. Brockway read a paper on the relation of modern mechanical appliances in dentistry to the health of the operator, showing their beneficial influences over the more laborious customs of former times; a phase of hygienic physiology of prime importance to all who follow our calling.

Not expecting to propound many new truths, I propose to begin where Dr. Brockway left off and extend the inquiry so far as to cover the ground of location of the dental work room; for this appears to me as important a phase of physiology as some of the more concrete aspects of this subject.

In discussing this question it will be strange if some of my remarks do not meet with strong opposition, for nothing is more difficult to overcome than old traditional beliefs, habits and customs. But what little may be said will be all the more earnest because of my having personally experienced the advantages and disadvantages of the different kinds of light.

The object is to show that the policy of working all day in a north light is not only unhealthy, but, that shaded light is no better for doing fine work than sunlight, if it be, indeed, so good.

* Owing to the great length of this report, extensive quotations from high medical and scientific authorities have been omitted as being simply corroborative of the facts already established.—[Pub. Com.]

The influence of "Sunlight" upon physiological life is one of those deep and almost unfathomable subjects which, with our present limited information, can only lead us to form conclusions in regard to its value from the sum total of its workings. As with the relation of vision to thought, and thought to brain, we must be satisfied, for the time, by the existence of their outward expression and inward feelings, that these things are facts, and that they are certainly functional expressions of degrees of intensity of physiological actions, which are more or less dependent upon outward forces through food, air and light carried to and digested in the chemical laboratory of the system by motion called exercise. To deny the essentiality of the dynamic potency of the triad of which sunlight is a factor, is to deny the truth of what we see. That occasionally there are to be found north-light dentists who, by their inherited iron constitutions, can withstand this violation of hygienic law, only proves the elasticity of their nature; but, as a rule, if we inquire into such exceptional cases we shall find that they are not constant workers, and have frequent "off hours" of out-door exercise.

It will not be advocated here that sunlight in its greatest midsummer intensity, when its heat may be sufficient to change some of the albuminoid substances of the tissues to a pathological condition, is desirable; but I simply wish to show the beneficial influences of moderate intensity of sunlight. Sir David Brewster says, "Sunlight is the very life blood of nature." "Where light is not permitted to enter, the physician will have to go," is the well-known old Italian proverb. The grateful and sweet power of sunlight is not confined to organic bodies, but extends over so-called inorganic matter also.

Leaving the links of theories and hypotheses of the analytical feature of light to the Tyndalls, Sommels, Magnuses and others, to work out the chain from cause to effect, let us survey the conclusions from experience among results as a whole, confining our remarks to the physiological and psychological influences of sunlight in relation to the occupation of dentists, who, as a class, still persist not only in the practice, but apparently in the belief that the north light is more advantageous to their well-being. They argue that because north light is more steady, it must be, as a matter of course, best; which is equivalent to saying that the muscles of the iris are not to be depended upon for adjusting the amount of light necessary to proper vision; as if development by the exercise and the education of the visual organs is a myth; as if artificial appliances about the windows are of no use or benefit; and, finally, as if sunlight operations are necessarily inferior to those performed in the shade of a north sky.

But, laying aside the subject of office practice and generalizing our thoughts, probably no question, by a body of men like this, would be more readily answered correctly than that the sun's rays are of the utmost importance for the maintenance of physical health, beauty, longevity, and integrity of the intellect; or that living tissues when confined for a considerable length of time from the sunlight, will undergo degeneration.

From times of old the sun has been considered as having more or less influence in the regulation of vegetable and animal functions, both in disease and health. Apollo was not only the name of the sun, but he was also considered the god of medicine, and was worshipped as such. The influence of shade is so general and so persistent in its effects upon organic life that although there are some few apparent exceptions, yet it may be laid down as a rule that all people who pursue their calling in places where the sunshine is hermetically shut out, suffer more or less in their physical and mental health. It is not necessary to examine into the life of the dungeon convict, or the underground rooms of filth and squalid humanity of "Five Points," in New York city, to be convinced of the baneful influence of a life in shade, yet these aspects may assist in convincing the skeptic. Compare the buoyant, cheerful, spirited, ruddy faces of open air laborers with the pale, cadaverous, emaciated, sober, depressed countenances of those whose habitations deprive them of the influence of sunshine. Visit the collieries, badly lighted factories, workshops and underground printing establishments. Visit the narrow alleys, confined courts, and garrets of dense cities. Compare the statistics of mortality and conditions of health of hospital patients who live in north rooms, with those who live in rooms where the cheerful sunlight freely enters. It is a well-known fact, says Winslow, who quotes largely from Virchow, that the effect of isolation from the stimulus of light produces an alteration in healthy blood. The fibrin, albumen and red corpuscles become diminished in quantity and degenerated in quality, and the per cent. of the watery portion of the blood is increased. In such condition the tissues become soft and flabby, leading to prostration of the vital energies, with a tendency to pathological changes of the tissues; and in this state, also, the body is very susceptible to all endemic or epidemic diseases.

Exactly in what manner the sun's rays act upon animal life is not understood in all particulars and details, but, as Dr. Bryson remarks: "why, in a state of perfect repose, the blood should acquire a brighter tinge and an increased force of circulation, provokes inquiries, the importance of which

the observant physiologist will not fail to appreciate. It is evident that there is a physiological benefit to be derived from a proper degree of sufficiency of direct sun's rays, which is as necessary to the oxygenation and stimulation of the cutaneous circulation, *per se*, as the rendering of the atmosphere better fitted and the more exhilerating for the deeper circulation; for it is a well-known fact that, deprived of sunlight, the blood degenerates, while from sunlight the feeble and anæmic often return to health." Yet how frequently do we see dentists afflicted with tendencies to phthisis pulmonalis, continuing and persisting in the practice of actual worship, as it were, of the old idol "north light." The life-generating, invigorating, sustaining power of the sun's rays is no fanciful hypothesis; it is the law of nature, which causes all life to generate to its highest degree, but which if disregarded, often occasions diseases, which, though so insidious in their nature as, at first, to be unnoticable, are yet so terrible in their consequences, and so disastrous and fatal in their results, acting with as great if not greater certainty than any of the devastating epidemics which are the dread of mankind.

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Dr. Willard, in his address before the New York Legislature and the State Medical Society said, "We believe that neither pure air nor exercise alone will serve the purpose of keeping the organized machinery of the body in a perfectly healthy condition. Innumerable diseases, it is certain, are produced by the impurity of the one, and the neglect of the other; and it is just as certain that the absence of sunlight will originate diseases, or, at least, predispose the system to them, of as serious a character as in either of the other cases."

To see illustrated the demand of vegetable nature for sunlight, go to the forest and see the yearning of the trees for top light; see them seeking it oftentimes at the expense of leaning many degrees out of the perpendicular. Observe the true and steadfast sunflower, with its face, like the needle to the pole, following most sedulously the sun. Notice the garden pole vines, the beans, the hops, as they creep around their staff after his soothing rays, all facing the east at the rising of the "God of Day," and facing the west at his going down. Notice the ivy leaves, which, when forced out of their places, will twist upon their stems and face the light again. Go to the farmer's potato bin, in the back and darker portion of the cellar, late in spring, and see that beautiful effort to reach the light. See the thousands of silvery vines all shooting parallel and in the direction of the window, and not one of the number so imbecile as not to actually know, as it would seem, the proper and the shortest route. I have seen vines from stray potatoes in the

dark and dreary rear of the cellar, extend twenty to twenty-five feet along the bottom and up the wall, as if really inspired by the thought to look, as it were, out of the window, or some friendly and inviting hole through the underpinning.

Although it is sometimes said that air may be pure without the aid of sunlight, and although, so far as relates to freedom from poisonous contaminations of a zymotic nature, or even of any other impurities of an obnoxious character, this assertion may be true, yet the negation of the factor of a proper amount of sunlight through it during a large part of the time is an imperfection, which, in so far as it pertains to the well-being of animal health, is to me a sufficient reason for condemning the term.

It is a notable fact, patent to all, that the tables of mortality show that those who are constantly exposed to out-door occupations (even with all the injury resulting from over exercise and hard labor to which so many are subject), enjoy the best health, and generally live the longest. On the other hand, statistics show that the greatest mortality in the country is among those who live in dark or shady quarters excluded from sunlight, and in cities on the shady and dark side of the streets.

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That want of proper exercise, both physical and mental, is the cause of much stagnation and rust in the bodily machinery of the human race, is undoubtedly true, yet it is also as true that this degeneration is much more rapid when accompanied by a life in shade than in sunlight. It is also equally true that any degree of exercise in shade is not as beneficial as when taken in sunlight, for there is the want of a stimulating element in shade, which is supplied to the system by the actual rays of the sun, over and above what is imparted to the atmosphere.

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Who has not experienced a happy change of feeling when passing from a north room, with its dead, staring light, to a south room, beaming and gleaming as sweetly as the promise of friendship, or the mellowed glance from the eye of love?

In some places in Europe the opinion is current that sunlight is of so capital importance that places are established for the purpose of sun baths for hildren, who are there exposed, naked, to the sun's rays as they penetrate the ground glass. The ancients understood this when they built their "Solaria," or sun-bath terraces, on the tops of their houses. Dr. Longworthy

says, "the influence of the same number of degrees of artificial heat for the same length of time upon the skin does not produce the same benefit as from the direct rays of the sun." Fourcault cites an instance illustrative of the sad and deleterious influence of too much shade in the conditions of a certain Orphan Asylum, where the children were much afflicted with chronic diseases, and where scorbutic affections prevailed, which, however, were followed by a very favorable change after the removal of several large mulberry trees from the immediate surroundings.

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Probably there is no better evidence on record of the necessity of sunlight for the maintenance of health than can be shown by the extreme negative arguments; as from the experience of Dr. Kane, who, during two years in the north, passed two nights of more than two months each in total darkness. For one hundred and twenty-four days at a time, the sun was below the horizon, and one hundred and forty days, or nearly five months before its rays fell again upon the brig. In an atmosphere free from adulterations of malarious, pestiferous or noxious emanations, "with plenty of exercise of the most active character, plenty of time to rest and sleep, with the same quality of food as was used during the sunlight, they found that with increasing darkness there came increasing disease."

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Sir James Wylie, of the Imperial Russian Service, remarked to an English physician who was visiting with him the barracks at St. Petersburg, that "three cases of disease occurred on the shaded side, to one on the sunny side, although the apartments on both sides of the building communicated freely with each other, and the discipline and diet and treatment were in every respect the same."

Florence Nightingale says: "second only to fresh air I should be inclined to rank light in importance; not only daylight, but direct sunlight is necessary for the speedy recovery of the sick."

Baron Dupuytren, one of the older French surgeons, relates an account of the case of a lady in Paris who for several years was afflicted with a great complication of diseases which baffled all her medical advisers; and her case was pronounced hopeless, until he ordered her to be removed from her dark room and sent to another part of the city where she was put into more cheerful quarters; where, exposed as much as possible to light, she rapidly improved. and in time entirely recovered.

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Perhaps no better and more conclusive evidence of the influence of light can be given than that shown by the results of some experiments by Dr. W. F. Edwards, who placed some frog spawn in a vessel made impervious to light by being covered with dark paper, and another quantity in a box permeable by sunlight, but otherwise under the same circumstances, temperature, etc. Those in the light developed in their regular time and order, but none of those in the dark did well, though in a few eggs some unmistakable evidences of transformation were noticed. He further placed deep in the "Seine" twelve tadpoles in a tin box pierced with holes sufficient only to permit water to pass; only two underwent the regular development of the frog. These results were corroborated by experiments of Dr. Hammond.

Now as to the claims of northern-light advocates; we find two. First and foremost, they say, north light is steadiest; secondly, that north rooms are cooler in summer. Granted that north light is steadiest, and north rooms are cooler—this second claim can be offset by saying, if the north room is cooler in warm weather, it is correspondingly cooler in cold weather, and neither argument is worth considering. Dismissing this, let us direct our attention to this steadiness which we hear so much about. In the first place there is no such thing as steady daylight; it is only relative; a north light on a bright day, undoubtedly is an excellent light for most operations, but on dark days it is insufficient; and in case of some operations in the posterior part of a deep, dark mouth, even the *strongest* north light I think is insufficient—certainly so with me. North-light operators must be content to work in the scale from a minimun to a little above medium degree of intensity of light, while with the aid of the adjustable screens on sunlight windows, the operator works in any degree of intensity, from the medium light of cloudy weather to the maximum of the sun's rays. I can do much finer operations and with much less fatigue to my eyes, by the south light, when I can get the direct rays to fall on the point of my work, than by any other light.

While passing Waltham watch factory, one bright morning, I was struck with the cheerfulness of many of the operators, both men and girls, who appeared to be ruddy and very healthy. I afterwards was led to correspond with the treasurer of the company, Mr. Robbins, relative to the subject now under discussion; he informed me that he "believed the south light more wholesome; that though the operators generally prefer the north light on bright days, they like a strong light, to be directed upon

the *point of work*, whether it comes from north or south." "On the south side, screens and curtains are in common use to effect the general shading, while the full strength of the light is allowed to come upon the work through openings in them." Although as well done, Mr. Robbins says he "cannot say that better work is done on the north than on the south side."

In reply to similar queries sent to the National Watch Company, at Elgin, Illinois, I was informed that their "buildings are so situated that at sometime during the day the sunlight enters nearly all the windows; and the rooms are narrow, with high ceilings; and they never have noticed any difference in the work on account of sunlight." If watchmakers, who work on open tables, can do as fine work in sunlight, is it not more reasonable to believe dental operations in the dark oral cavity can be as well done when illuminated by the direct sun's rays.

In 1873 I had a bay window built on the north side of my office, eleven feet wide and five and a half feet deep, with very large north and west side windows and a skylight five feet square, affording as much light as can be well obtained from the north. Entering this bay in a high degree of health, after a vacation trip twice across the continent, consuming several months, and being closely confined to business during the day, (never at night,) seldom allowing sunlight to fall upon me, I found myself growing weak and very pale. At the end of the year I had a cough, which not only became in a measure chronic, but was steadily increasing, to such an extent that my acquaintances believed I had, or was passing into, phthisis pulmonalis. This weakness of the general system and close application in the operative department of our profession, was followed, after about a year, by a trouble in the eyes, causing pain in them when closely used in fine work, especially during cloudy weather.

Feeling that my health might be improved, I built another bay window, of the same dimensions and kind, on the south side of the house, with proper shift curtains, so that I could regulate the degree of intensity of the light, to suit the various operations, and always, when possible, permitting the sun's rays to pass through a space between the skylight curtains, so as to shine directly into the patient's mouth, (not in the eyes,) and occasionally upon myself, as I moved about, and before six months, under the same amount of labor and close confinement, I found my cough had left me, and my complexion had changed from a waxy, cadaverous whiteness to a look of vigorous, ruddy robustness, and my vision had become strong and endur-

ing, and, to my surprise, I found I could do a finer quality of work than ever before, and with much greater ease. After operating in this south bay-window eighteen months, I moved to Brooklyn, where, at an ordinary southern window I continued to experience the same benfit, though to a more limited extent. Anyone who has once operated in a large bay, knows how disadvantageous and inferior an ordinary window is to work by.

Finding it necessary to change my business location, I found myself working during several winter months by a west window, where, owing to tall houses near, the sun did not shine into my office for three months; my health again began to fail and my eyes troubled me so that I was obliged to abandon my evening studies for several weeks, in order to save them in proper condition for day work. As spring approached and the sun rose high enough to shine above the opposite houses, my health improved and my eyes became stronger until the spring foliage on the trees before the house cut off my light, when my eyes began to pain me again, when I changed my working place to an east light, the best I could command, which in the morning admitted the sun's rays, and my health and my eyes improved again; but no light is as good for me as the southern, and as soon as I can find a suitable house, I shall again work in the south light; for this experience satisfies me of the truth that "where there is sun there is thought, and cheerfulness, vigor, and strength."

If I could make it convenient for patients, and I could have just what I want, I would have my operating room in the top of some part of my house in the form of a skylight observatory, with side windows all around, where, with suitable curtains and shades and a chair in the center, I would always, when possible, face my patient so as to get the direct sun's rays upon the point of my work. Probably a more practical arrangement would be a very prominent bay window projected from the southwest corner of a block of buildings, so planned as to permit the sunlight to shine into it from morning until evening.

DISCUSSIONS.

Dr. McQuillen: The paper just read is an able one, and has gone so fully over the ground that there is very little left to be said. Twenty-four years ago I published a paper on "The management of light in the performance of dental operations," in which I took ground in favor of a northern light. I am now convinced of what my friend Dr. Townsend said to me, that it would do very well for a young man to talk about northern light, but the time will come when you will be in favor of the southern light—a strong light, modified by the use of a screen.

After being confined all day to the office, it is important, on going out, to walk in the sun; and, when not too hot, to seek the sunny side of the street, and not the shady side as is generally done. I arose to offer my thorough endorsement to this valuable paper.

Dr. Spalding: I desire to add my commendation of the general character and substance of the paper read. There is one experiment which was tried by Dr. Edwards, which, I think, bears strongly upon this subject. In his experiment upon tadpoles, he excluded certain subjects from the light, and, while they grew to an enormous size as tadpoles, they did not develop into frogs. In the course of his experiment it occurred to him that he might supply that defect in some other method than by the rays of light, and consequently he commenced feeding to the frogs, grass and other vegetable structures which contained chlorophyl, which is only formed by the direct or diffused action of rays of light. Plants grown in the absolute shade are without chlorophyl. The consequence was that on green food these identical tadpoles, while remaining in the dark, rapidly developed into frogs. That suggests the point that something may be supplied to dentists and others who are habitually in the shade, in the way of food, that would take the place of light. Hence it has been my habit for many years to live largely

upon green vegetables when they have been accessible. I operate by a northern light, but I doubt whether it is best to do so. I believe I have done considerable towards remedying that defect in the selection of food.

Dr. Waters: I operate by a northern light. I find that fruit has enabled me to feel a great deal better, have a clearer head and better eyesight, than when I lived on a mixed diet. I like those things that are developed in sunlight. Early in the spring I obtained some tadpoles and placed them in my office in a glass vessel, and fed them, and gave some to a friend, who placed them, also, in a glass globe, and used that glass globe to keep a bouquet in. While my tadpoles grew, as tadpoles, to a large size, and very rapidly, the other tadpoles, given to my friend, did not increase in size, but minute legs began to develop, and they became frogs in a few weeks. These were kept in sunlight; mine grew in the shade.

Dr. Rehwinkel: If this paper were in print and in the hands of dental practitioners for distribution to their patients, it would be well. It reaches the whole community, and that part of it which ought to read and know it. In many families the sunlight is carefully excluded from parlor and hall, and too much so from living rooms and nursery. It seems to be a characteristic of American ladies, of finding great comfort in dark rooms from which the sunlight is banished. I believe if we were to distribute to mothers, this paper, impressing upon their minds the importance of reading it understandingly, we would not only benefit ourselves, but mankind in general.

I have operated for the last fifteen years by a northern light; prior to that, eight years by an eastern light, having the sun in the morning. A friend of mine, who has operated about three years by a southern light, told me the other day, that, taking everything into consideration, he liked it fully as well, and in some respects better than a northern light. As for this paper, it is of that character that I cannot argue against it. It is a subject upon which we are fully prepared to pronounce final conclusions. Nothing can be said against the arguments sustaining the writer's position; they are all good and forcible.

Dr. Thomas: As has been remarked, the paper has gone over almost the whole ground; but there is one point left out, that to me is very important. In one place the author makes this statement: "that people choose north rooms because they are cooler." That is a mistake. If you will observe in the heated terms, from which quarter we get the soft summer

breezes, you will find that they are almost invariably from the south. If you want to get a breeze in your house, go into a south room. In cold weather we get the blasts from the north, when we do not want them; but in warm weather we want a southern exposure in order to avail ourselves of the summer breezes, and in winter to secure all the sunlight possible.

I want to offer my hearty testimony in favor of the southern light, having for eight years operated in a full southern exposure, my office facing a large open square. When I went into the office, dentists who came in to see me would almost invariably speak of the light, asking how I could get on with the south light. They almost made me believe that I had made a very unwise choice. I availed myself of muslin curtains, hung from both top and bottom of the windows, and I very soon accommodated myself to the light; and the day was never so dark but that I could see my work very well. Two years ago I built an office and house together, and I put the office, I am sorry to say, in the north-east corner of the house. When we are in health we do not know what it is to be sick. I did not fully realize what a blessing sunlight was. I have now a light that comes from the north, and from the east, and a skylight. The skylight, in my opinion, is a failure. Cross lights are not desirable. If I could so arrange it again, that I could secure a south light, I certainly would do so. Don't be afraid of the sunlight.

Dr. Barker: There is a great deal involved in this subject of light. The question is not, as the paper would suggest, the influence of light upon an individual out of health, but it is whether a dentist can operate most beneficially to himself and his patrons at a north or south window. Everyone must admit that sunlight is imperatively necessary for the health and well-being of every individual, and particularly so if at all indisposed; hence it is not surprising that Florence Nightingale found that the wounded recovered more rapidly, and the mortality was less, on the south side of the hospital than on the north. In my judgment the paper presented, advanced one vital error; it states that individuals who live in the open air, and instances agriculturists, are the class that enjoy the best of health, and generally live the longest. It has been proved by statistics carefully prepared, that this very class are in the proportionate majority in our insane asylums, and hospitals; and mortality reports show that merchants and professional men, who pass but a small portion of time in the open air, are the longest lived and the most healthful. I do not think I am claiming too much when I assert that the combined testimony of all skilled artizans in delicate work-

manship, such as jewelers, engravers, artists and makers of methematical instruments, is in favor of north light; and I have been told invariably by many such workers that their eyes were sure to be injured if they used, for a length of time, any other. The paper refers to one of the watch factories, where most of the work is done by machinery; in these each person performs one single branch of labor, an this is so constantly repeated that it becomes automatic, and hence demands but a small amount of mental and physical labor; this, however, is not the case in dental practice, for each operation, however slight, differs from every other, and calls for intense mental and bodily exertion.

The views presented by the essayist were in direct opposition to those which had been advocated by the majority of practicing dentists in the United States, and, unless excellent reasons to the contrary are advanced, the old opinions should still be adhered to. For myself, I can say that twenty years experience with north light enables me to speak in its commendation. I cannot understand, as suggested by the paper, how any one could possibly operate by sunlight, for rays of sunlight falling upon a bright surface like a gold filling, would be reflected, as from a mirror, to the eye of the operator, and most certainly interfere with, if not destroy, vision. It might be contended that by the use of window shades the rays of light would not be reflected as just described, but this was not what the paper advocated, for if I understood it, it took decided ground in favor of dental operations being performed by sunlight. A strong argument in favor of north light in contradistinction to that from any other point of the compass is, that the variations are decidedly less, and hence there is much less necessity for constantly regulating the focal distance of the eye, and less change in the iris and pupil, unvarying light favoring normal sensibility of the retina. I think that the dentist often injures his eyesight by having rays of light enter his operating room from more than one point of the compass, and it should, if possible, be avoided.

Dr. Kulp: Theorizing is often quite a different thing from practice. For many years I thought I could not operate with any but a north light. Being compelled to change my light to an east light, I did not like it as well as the north, and I aimed to get back to a north light again. But for the last eighteen months I have been compelled to resort to a south light instead. For two years previous to that time it was necessary for me to wear spectacles on some occasions in operations, but since I have gone to the south light I have thrown my spectacles aside.

DR. BARKER: Do you think the south light cured your eyes?

DR. KULP: Yes sir, I certainly believe it had much to do with it. I prefer to have something green to rest my eyes upon, and for that reason I placed a flower stand in the corner of my room, containing a variety of plants, and when I am tired I rest my eyes on them, and I think that the rest I get on the green foliage, with the south light, has restored my eyesight.

DR. E. PALMER: As I value my life, I would not dare to shut myself out from the sunlight. Ten years ago I gave up my practice in the East on account of pulmonary difficulties, came West, and soon felt so nearly recovered that I again commenced the business, taking rooms with only a north light. In three months I was compelled to quit my office again for several months. When next I resumed business it was in rooms having a south and east light, and am convinced, beyond a doubt, that it has been due almost entirely to the influence of sunlight that I have been enabled to continue my practice constantly ever since. My laboratory is lighted by a skylight, and, if occupied there, I sit, when I can, where the direct rays of the sun fall upon me.

I heartily endorse the sentiments of the gentleman who has just spoken, in relation to the admission of sunlight into our houses. The blue light theory, if it fails to accomplish all its advocates claim for it, has been the means of throwing open the closed shutters of many a house, and, throughout our land, awakening an interest in, and a desire for, the healthful, cheering properties of this divinely appointed life-giving agent.

DR. A. W. FREEMAN: I worked for seven years by a northern light, became pale, and lacking in physical energy. I changed my office so that I operated at a large window on the south side of my house, and for the first six weeks I thought I should have to give up work by that light, as it was too strong for my eyes. But, having learned to adjust the light by a thin screen, I would not go back to a northern light for any money. Physically I soon felt better, and I know by experience that it is the best light for me to work by. I think pallid, nervous dentists, and those inclined to pulmonary troubles, will find the southern light a good tonic.

DR. ATKINSON: Gentlemen who have detailed experiences do not seem to be able to derive from them the instruction that is in them. We

have a thousand experiences every day, and an immense accumulation of facts, without being able to correlate them so as to indicate the principle upon which they are based.

My first criticism is, that Light is *light*, and when you come to differentiate it and take different modes of light, then you have to use an adjectival or adverbial form of phrase by which to designate the quality, or quantity, or character of the light. When we say that all life depends upon the sun's rays, we have simply announced a truism; but when we ask how certain kinds or modes of light manifest themselves, and learn that they are displayed more particularly under some deflection or prismatic effect upon the pencil of light by splitting it up into its actinic and its different colors, then we begin to get hold of the mode of motion that will enable us to comprehend why certain constitutions require a larger amount of light, and others a stronger degree of light. Those persons who have much pigment in their eyes, absorb a great deal of light, and can, like the eagle, "stare the sun in his face;" but those who are blonde, and have little pigment, will not be so able to bear the glare of the sun. These are very interesting principles.

It has been said that there is no chlorophyl in leaves not immediately exposed to the direct rays of the sun. The gentleman has forgotten that chlorophyl legitimately means the leaf substance, that is, the matter lying between the cells of vegetable tissue, and is not necessarily green. It was impliedly stated that the chlorophyl was able to catch and hold the sunlight, and so embody it as to introduce it into the pollywog's body through his digestory apparatus. He said there could be no chlorophyl without direct sunlight.

Dr. Spalding: Or diffused.

Dr. Atkinson: Then you could get it in the darkest hell, for there is some diffused sunlight there. It does not make so much difference how you get the sunlight within you, if you get it so as to appropriate that particular differentiation of the white light, or the sunbeam which ministers to the building up of the tissues; and this may be secured by reflected light, or by direct light. But remember that the direct light never comes into the human eye when you are looking upon an object that is within the reach of your fingers to touch. There is only one way you can get direct sunlight, and that is to look directly at the sun. Even if you look into the

looking glass which reflects ninety-nine per cent. of the rays, still it is reflected sunlight. But we make differentiations very crudely and coarsely, and we do not seem to comprehend what we are talking about, while we seem to think that our individual experience is the standard of all experiences. This is the only objection I have to the report: that the author has taken *his* position as *the* standpoint, and that there is no other. I think there have been more eyes injured by using too much light to see fine objects, than there ever have been by using too little light.

What is it that enables us to see at all? It is enough light to set in peculiar motion the rods and cones of Jacobson's membrane in the retina that forms the image, like the ground glass in the image plate of a camera; and when we have light enough to enable the image to be formed, then the consciousness behind the eye takes cognizance of that, and this is as various as the constitutions or organizations of individuals. Let it be said now and forever that truth does not wait the votes of anybody. Truth is truth, and all she asks is to be announced in understandable form, and not bolstered up by half-truths anywhere.

Our mistake is that we think an author, by being quoted voluminously, shall sway the eternal principles of verity. Away with such childishness. Let us come to our majority and be able to say yea or nay to every proposition. That is the great trouble with us in this great convocation—the "*senatus senatorum.*" We should forget these embryonal babblings, and come up to the comprehension of the principles involved, and let the details go, when they cannot be further utilized to illuminate our comprehension of the operations of the laws of our being.

Dr. Spalding: It was because I regard this body as the senate of the profession that I did not attempt to go into the principle involved in the development of chlorophyl. That is the reason I made my speech very brief.

Dr. R. R. Freeman: We may not understand all the rules that regulate life, but we all recognize the fact that sunlight is necessary to health; but the question is, whether or not it is better to operate under a northern or a southern exposure. I had two years experience operating under a northern exposure, during which period I operated pleasantly at all times. For five years I have operated in a southern exposure, where I have the

sun pouring in until about two o'clock in the afternoon. In the morning I find that I operate with less satisfaction to myself, and I find that the reflection from the gold upon my eyes is painful. I may adjust my curtains and operate comfortably for a short time. but the clouds flit before me, and directly the sun is out, and then there are a thousand little mirrors that cause a reflection on my eyes which is injurious. In the afternoon when the sun goes away I can operate again. I also observe another point: when the direct rays of the sun are falling upon the face of my patient, my hand gets in the light, and I operate with much less facility and satisfaction to myself than when I have a northern light; and it is questionable with me whether it is not better to operate so that the sun may have some play upon you during the day for the benefit of your health. Dentists should recognize that principle, and they should not operate all day long in the shade, but should take sun baths; but when they want to operate pleasantly and agreeably, let it be in a light that is not flitting, that is not glaring; but a pleasant. modified northern light.

Dr. Judd: I wish to call the attention of the Association to the fact that in relation to this compilation in the paper in regard to sunlight and its influence in restoring health to the afflicted, and so forth, we are not, as many seem to suppose, for the first time throwing a great deal of light upon this subject. I wish to remark that these same views have been impressed upon the community at large for many years by the medical profession. It will have been noticed that nearly all of the experiments mentioned in that paper were made by medical men, and we must not for a moment suppose that we are about to broach something new, and impress it upon the world as our own discovery. It does not follow that it is necessary for a man to be in the sunlight all the time by any means. We have no statistics from any quarter that will justify any such doctrine. A certain amount of sunlight is necessary for the largest health, and it is our business to find out what is necessary for the highest enjoyment of life. I had no doubt. and if I had doubts before, I should have none now, after the testimony adduced by speakers here, that there are certain eyes better calculated to operate by a northern light than by a southern light, and there are eyes better formed to accommodate themselves to a southern light in their operations. After having tried a southern light, I had to return to a northern light, my eye being so constituted that it would not act kindly in a southern exposure. In settling this question each one of us must settle it for himself. (Applause.)

Dr. McQuillen: That which can benefit an invalid will do no injury to those who are well. The great advance in medicine in the past twenty-five years has not been due to excessive medication, but to the recognition of hygienic laws, and enforcing their observance upon the community.

Reference has been made to the fact that farmers, who are supposed to enjoy so much advantage from exposure to the sun, often become insane, while with professional men and merchants, who are confined to dark rooms, the ratio of insanity is very small. Prof. Barker certainly would not wish any one to draw the inference from his remarks that exposure to the sun is the reason why farmers become insane. The large ratio of insanity on the part of farmers has been justly attributed to the fact of their being cut off from the healthy stimulus of society, of having certain fixed work to do, and limited ideas for the mind to dwell upon; while on the other hand, the professional men and merchants have a variety of occupations for their minds.

Years ago arguments were presented in my paper in relation to the artist, the merchant, etc., that the northern light was of benefit because of its constant steadiness, and of its being from the pure blue sky; but the experience of twenty-five years with a northern light, and still using the northern light, convinces me that there is much force in the arguments in favor of the southern light.

Dr. Barker: I did not pretend that the cause of mortality, crime and disease among agriculturists was due principally to their being exposed to the sun's rays, nor do I think my remarks could be so construed; but the essayist had referred to this class as the one most favored in life and health.

The paper alludes extensively to the influence of sunlight upon persons who are diseased, and also to those who are engaged in occupations where the sun's rays cannot possibly enter, relating facts which no one will attempt to disprove. The reasons adduced are, however, no arguments for the dentist, for he need not confine himself to his operations so closely as to be deprived of sunlight; and any one so doing has no one to blame but himself if his health suffers.

Another point is in reference to the mortality that exists among the poor of large cities, where they are deprived of sunlight, and the children, if living, are apt to be sickly. This is only a part of the truth, for while it is a fact that we find mortality and sickness very great in such classes of society, it is not, as suggested by the paper, because they are alone deprived of sunlight, but is also due to the absence of all hygienic influences, as good food, good air, good drainage, and every condition that tends to promote health and long life.

REPORT OF THE COMMITTEE

ON

PATHOLOGY AND SURGERY.

By F. H. REHWINKEL.

Mr. President and fellow members of the American Dental Association:

Allow me to present for your consideration a few thoughts, more in the way of inquiries into the causes of, and conditions attending that formidable disease of the gums, root-membranes and alveolar processes, known as *Pyorrhœa Alveolaris.*

It is difficult to classify this disease properly. Some authors claim that it is a peculiar phase of chronic inflammation of the root-membrane, aggravated by constitutional causes; others, especially American writers, treat the affection as of local origin and as a diseased condition of the gums, induced by foreign deposits upon the necks of the teeth.

Upon a superficial view, it may seem strange that such a radical difference of opinion should exist among writers upon this subject.

Reflection, and a careful study of the varied conditions which diseased gums present, will prove the almost impossibility of exactly determining where to draw the line between constitutional and local origin. European and American writers also differ as to the seat of this disease, as well as to its nature.

According to Edward Albrecht, M. D., of Berlin, the author of a treatise on diseases of the root-membrane of the teeth, Soirac, a French physician, is entitled to the credit of being the first author who presented this affection in a special and distinct form.*

In describing the pathological conditions connected with this malady, Dr. Albrecht says: "The disease consists of a purulent suppuration of the gums, and has been classed with scorbutic affections. It appears at any age, most frequently, however, between that of thirty-five and fifty years; plethoric and fleshy persons, those inclined to fatty accumulations, are particularly predisposed. Both sexes are liable to its attacks, and especially women during the climateric years."

After citing the progress, also the accompanying symptoms of this disease, he enumerates the causes; among which, the following claim our special attention:

"Want of cleanliness of the mouth; accumulation of tartar upon the teeth. Damp and badly ventilated dwellings, and all those conditions which reduce the vitality of the body. Mercurialization, sudden suppression of habitual secretions. Metastase of skin diseases, Scrofula, Rheumatism."

The author then goes on to describe some of the peculiarities attendant on the disease, and lays before us a picture, with which we are all familiar. He further says:

"Although this affection may at times be purely local, in the majority of cases it is dependent upon constitutional conditions, and stands connected with certain periods of development at different times of life. In some cases it may cause the loss of all the teeth, though from six to ten years may elapse before this is accomplished. In other cases the progress of the disease is much more rapid; again, there is sometimes a sudden cessation of the symptoms, even when no medical or surgical treatment has been resorted to, and when purulent suppuration has taken place; and although the teeth will probably remain loosened in their sockets, further progress may be arrested for, perhaps, years;—when all former conditions may re-appear, and terminate in the loss of the teeth. In the majority of cases all symptoms disappear after the removal of those teeth from the sockets of which the exudation of pus has taken place, so that it would seem that these teeth were the sole cause of the disease; in consequence of which,

* Desirabode: Revue de Thera. Pointis. Journ des connaissances med. practiques, Septbr. 1845.

Fouchard and Jourdain looked upon this affection as a purely local one—the result of an effort of nature to throw off organs no longer possessing vitality. The removal of these teeth, however, insures no permanent relief."

Wedl's views correspond with those of Albrecht; he also classes this disease among inflammatory affections of the root-membrane, and corroborates some of Albrecht's views. He quotes the opinion of the above mentioned gentleman, that the pressure of the tongue and its constant sucking action upon the lingual surfaces of the alveolar processes, prevents the accumulation of the purulent matter, and that pressure by the finger upon the latter surfaces does not give vent to a puriform fluid, unless the affection is very far advanced. Wedl here admits that "in these cases, then, we have to do first of all, with a catarrhal inflammation of the gum, which afterwards extends to the root-membrane."

Salter, in his work on Dental Pathology and Surgery, does not mention this disease under the name of Pyorrhœa Alveolaris, but embraces it in his description of "False Scurvy, or Spongy Gums." Although he does not materially assist us in tracing the original seat of the trouble, he is very decided, however, as to its causes and character. He says: "The gum, the subjacent fibrous tissue, and the periosteum of the alveoli, are so continuous in structure, that they suffer together in this condition, and where the malady has been of long duration, the sockets become less rigid around the tooth-fangs, the edges of the bone become absorbed, and the teeth loosened. It is also attended by a considerable increase of the ooze which is secreted immediately around the teeth, and in some cases which are acute, this secretion is certainly purulent. Pus is readily formed on the surface of certain mucous membranes; but in the gum there is a special structure from which it appears to emanate."

"The causes of this malady are neither constant nor always intelligible. It is frequently associated with chronic dyspepsia and general ill-health. It also occurs very often in females who have had frequent pregnancies, and in both sexes it frequently seems to depend upon irregularities of the teeth; in some instances where they are crowded, and in others where they are much separated. Another frequent cause is mercurial action at some previous time of life. Patients may have taken mercury even to a slight degree, and the gums may have apparently entirely recovered themselves, when at a distant period, sometimes many years afterwards, spurious scurvy will arise and produce rapid absorption of the alveolar processes, and loosen the teeth."

The opinions of other prominent European practitioners, given in papers read before societies, or verbally, in discussions of diseased conditions of the gums, as a rule, admit that constitutional causes are mostly underlying this disease; very few, however, seem to think it is a matter of moment, more accurately to define this disease as a separate and special pathological condition. In fact, our literature is barren of any accurate description and definition of what I understand by alveolar pyorrhœa.

Our American authors represent this disease invariably as the sequence of local causes, and chiefly due to the deposit of salivary calculus on the necks of the teeth; and although they give general descriptions of the progress and peculiar features of this malady, they yet seem to ignore the idea that the disease may have existed for a considerable length of time, and may have become complicated with the added symptoms of spurious or false scurvy.

Dr. Ingersoll, of Keokuk, Iowa, in his excellent essay on "Diseased Gums," read before the Iowa State Society, May 2d, 1877,* makes an easy transition from "false scurvy" to pyorrhœa alveolaris and back to the former disease. We find in this essay a valuable and condensed treatise upon the anatomical structure of the gums. together with a rational account of morbid changes and diseased action pertaining thereto, and with most of the accompanying phases of "spurious scurvy." This paper is a valuable contribution to our literature.

Dr. Geo. A. Mills, of Baltimore, in writing on "What I know about Riggs' Disease (so called)," in the Feb., April and July Dental *Cosmos*, 1877, likewise gives us an interesting account of many of the peculiarities in diseases of the gums. These papers evince close observation and well digested thought, and give us true and interesting pictures of the morbid conditions which present themselves so frequently.

The author alludes to a resolution passed at a meeting of the Connecticut Valley Association, a few years since, giving credit to Dr. Riggs, of Hartford, for some originality, relative to new and special features in the pathology of the disease caused by, or connected with, deposits of salivary calculus in the oral cavity.

Dr. Mills proceeds to give some of the views of Dr. Riggs; also describing his treatment of the diseased gums and alveolar processes, which

* See *Dental Register*, June, 1877, Page 229.

views and treatment he fully endorses. Besides this, the author adds many interesting and valuable points, based in part upon his own observation, as well as upon the testimony of other writers.

These papers are the latest productions of prominent American practitioners, and although Dr. Mills, in describing his own case, admits that "the disease may have been at work for perhaps not less than twenty years, with a general healthy appearance of the tissues about the surfaces where the brush had been faithfully used, there was shown by the pressure of the thumb and finger on the buccal and lingual surfaces an exudation of pus from between the bicuspids and molars, and the treatment proved that there had been an extensive destruction of the osseous tissues in this territory," leaving us to infer that it was owing to purely local caues.

Dr. Mills' case of alveolar pyorrhœa, furnishes excellent proof of what I shall endeavor to establish, viz: That pyorrhœa may and does exist independently of foreign deposits, and that it does occur in the cleanest of mouths—and must for its origin depend upon other than mere local causes. I am sustained in this position by an account of an epidemic outbreak of alveolar pyorrhœa reported in the "Deutsche Vierteljahrschrift fur Zahnheilkunde," by Herr Zahnarzt, M. Schlenker, of St. Gallen, (Switzerland.)*

From this account it appears that in the month of May, 1876, a typhoid epidemic appeared in the city of St. Gallen; the origin of the disease was supposed to be contamination of the water by which the city was supplied, and which was used for culinary purposes. This epidemic lasted until the following autumn, despite all sanitary measures which could be adopted, and which were most vigorously applied. The disease was confined within the city limits, and Herr Schlenker states that he and his wife, both of whom had good teeth, were with many others, attacked by gingivitic blennorrhœa. He tells us that this singular feature aroused an intense interest in himself, and he set to work to ascertain if possible, whether this disease was connected with the epidemic. He cites quite a number of cases, and gives a complete symptomatology; all the different phases and expressions of the disease are represented, from the simple tenderness of tooth and gum, to enormous swellings and spongy growth. In some cases the attacks were very sudden, and within twenty-four hours the disease was fully established. In the case of a woman, the gums were inflamed and swollen only where the teeth had been lost and where the

* See Vol. XVII No. 1, Jan. 1877.

plate of artificial substitutes rested. In another case the whole oral cavity was much inflamed, and the gums very much swollen and exceedingly painful; this person had lost all the natural teeth and had never worn artificial dentures. Herr Schlenker examined some of the teeth lost, and found the root to be either partially or entirely bereft of periosteum. He subjected the secreted matter to the microscope, and was astonished to find, instead of the expected pus corpuscles, a "little world" of living things,—leptothrix, matrix, oidium albicans, different kinds of bacteria, etc., etc. He says: "In all cases presented to me, the secreted, light-grayish matter was subjected to microscopic examination, and I invariably found the vegetable parasites in enormous quantities and strongly developed, particularly the bacteria. Pus corpuscles were not present." "The absence of the latter may possibly be explained by the fact that they were consumed by the parasites as food."

He then draws the conclusion that the presence of these parasites was the cause of the inflammation of the root-membrane. Having as he believed, discovered the cause of the disease, and as he was experimenting with salicylic acid, he concluded to try a concentrated solution in his own case. He applied it by means of a small camels-hair pencil to the buccal surface of all the front teeth. The effect produced was a burning, drawing pain at the place of contact; in one hour afterwards, the mucous membrane could have been lifted off from the gums, notwithstanding the mouth had been rinsed with water immediately after the application. He did not continue this experiment any further; the case remained *in statu quo*, without further treatment, and finally with the disappearance of the typhoid epidemic, the blennorrhœa also took its departure.

In the case of his wife, a mouth-wash with salicyic acid was used for a period of four weeks without producing any change, either for better or worse. In July she went to another part of the country and used the waters of Sideris, Canton Graubuenden (Isenseuerling chalybeate waters), which, together with the atmosphere, extraordinarily rich in ozone from pine forests there, banished every trace of the disease in four days.

The author then goes on to say that an alcoholic solution of thymol 1:100, proved the best remedial agent in the disease, freely applied by means of a small hair pencil, so that the fluid could reach every part of the gum and socket; repeated every two hours. After every meal the mouth was thorougly rinsed with water; and particles of food were wiped away from the pockets formed by the loose gums about and between the teeth,

with soft cloths; after which an astringent mouth-wash, to which thymol had been added, was used. Under this treatment, cases in which the teeth had become very loose, are reported cured within a few days.

In the July number, 1875, Deutsche Vierteljahrsschrift fur Zahnheilkunde, Page 305, a case of alveolar pyorrhœa is reported by Herr Friderich Schneider, Hofzahnarzt, Sondershausen. The patient, a young lady of eighteen, otherwise healthy, free from scrofulous or tubercular diathesis, had been under the treatment of several physicians for a considerable length of time without receiving any benefit. The case had so far progressed that the teeth had become loose, and purulent matter was oozing out from the sockets in considerable quantities. (Let it be borne in mind that this case was not in consequence of accumulation of tartar; nothing of the kind.) In looking for causes, Herr Schneider found that this young woman, eighteen years old, with perfectly developed physique, had never menstruated, and he suspected that the congested state of the gums, the subsequent inflammation and all other morbid action, was in consequence of this abnormal condition. The extraction of two of the lower bicuspids and a lateral incisor of the upper jaw although the teeth were quite loose and with but slight attachment, produced such violent and persistent hemorrhage, that plugging the sockets became necessary.

The treatment in this case consisted of local applications and suitable hygienic measures, together with such medicaments as would act upon the uterus, and conduce to the appearance of the menses. The local treatment somewhat checked the progress of the disease, and, when after three months, the first menstruation took place and was afterward regularly established, the disease disappeared, and the remaining teeth became firm and useful.

I could also cite many cases in which the origin of the disease must be traced to the action of mercury, and in which this evil had existed for a long period; there having been no deposits of calculus; and where the disease fluctuated for years between improvement and relapse, until finally, the patients becoming discouraged, quietly submit to the gradual loss of their teeth.

In other constitutional diatheses, especially syphilitic, a tendency will frequently be found to alveolar pyorrhœa. Not less is it true that a predisposition to this kind of affection is found as an inherited family peculiarity. I have a number of cases in my mind where this is so manifestly plain, that there is no room for doubt. One case is particularly striking.

A gentleman, a resident of the state of Missouri, formerly of Chillicothe, who was possessed of, I believe, the soundest, most splendidly developed and altogether as fine a set of teeth as ever I saw, consulted with me from time to time during the last fifteen years in regard to his teeth and as to the best means of their preservation. The teeth were perfectly sound, the gums healthy, kept scrupulously clean, and the whole man a perfect picture of health. Notwithstanding all this, he seemed to actually suffer from some undefined dread in reference to the state of his teeth. This seemed to me entirely unaccountable; he told me that either his father or mother, I am not sure which, had lost his or her teeth, not from decay, but from their getting loose and dropping out. He therefore was determined to do everything in his power to preserve his own. Up to the last six or seven years, when I last saw him, there was no trace of the disease. I have recently learned from a professional friend in St. Louis who had been consulted by him, that the disease had become established in his mouth. I do not know the state of the case at this date. I mention it as being extraordinary. If care and attention had availed anything, I am sure he would have escaped.

Again, I have had the opportunity during my twenty-five years practice, of observing this inherited tendency among families who have been my patients ever since I have been in practice. I have had occasion to see the commencement and gradual progress of the disease, together with the later accompaniment of deposits of tartar, and also most of the phases under which it presents itself. I am fully convinced that there are other constitutional causes, which I refrain from enumerating, as it would extend this paper beyond reasonable limits.

There is one feature of this disease which is not only remarkable, but also very lamentable. I believe in the majority of cases which occur sporadically—the best class of teeth, those possessing the greatest density, of faultless development and excellently well cared for, seem to be those most usually attacked.

There is a great deal said and written about the necessity of the most thorough removal of the deposits of "tartar" from the roots. Are the granular deposits found on and about the crusta petrosa real salivary calculus? Has any one ever investigated this subject? Dr. H. S. Chase, of St. Louis, in his excellent paper on "Alveolar Periostitis," presented at this Association at the session of 1873, says, among other things, (Page 72, Proceedings 1873), "The interesting phenomena of the incrustation of the roots, repeated

every few days, until the reparative process was set up, is easily explained, being only a deposition from the albuminous discharge, which was *super*-saturated with sodic chloride, the salt being abundantly found in all protoplasms ready to undergo synthetic transformations. Moreover, this patient was a great consumer of salt as a condiment with her food." *

"No thinking person, I am sure, would confound this incrustation on the root with ordinary tartar; but it is analagous, though not the same in chemical composition, to the incrustation found on the ends of those which have been extracted where this disease has been local; only one or two teeth having become sore and loose."

In examinations made by Schlenker, he observed an entire destruction of the periosteum; and, again, in teeth which had yet retained some hold in the socket, this membrane was in some spots hyperæmic, and covered by new osseous deposits.

There certainly are some mysterious phenomena attending this disease which are not as fully understood as they should be. Individual observations and opinions, singly, can have but little weight; collectively they may become valuable aids in arriving at correct conclusions.

It would be both interesting and instructive if statistics could be collected from different parts of the world concerning the peculiarities of this disease.

Ireland and Scotland, whose inhabitants have the "best teeth," as is generally admitted, could, I think, furnish interesting information on this subject. I believe that if this Association were to address the profession of England, Ireland and Scotland, as well as France, Germany, Switzerland and Holland, asking for accounts and observations, an interesting chapter of Dental Pathology might be compiled therefrom.

What is understood by "Riggs' Disease," and why has it received this name? In order to enable me to give a satisfactory answer to this question, and also to learn the views of Dr. Riggs concerning this disease, as to whether he regarded it as of local or constitutional origin, I addressed a letter to him on this subject some six or seven weeks since, stating my object, and pointed the above questions; informing him that my search through

* A fact often observed in connection with this disease.—R.

our literature for something from his own pen had been in vain, and asking him to please point out to me where I could procure papers or reports written or made by himself, in order to embrace them, in part, in this paper. This request (made politely), has received neither reply nor notice. We must, therefore, rely upon the friends of Dr. Riggs, if there are any present, for answers to the above queries. Again, what are the new and special pathological features discovered by Dr. Riggs? From the statements of other writers we infer Dr. Riggs' opinion to be this: that there is necrosis of the alveolar borders, and that excision of the necrosed portions down to and beyond the line of demarkation between the diseased and healthy bony tissue, is the only radical cure for "Riggs' Disease." As the Doctor chooses to remain silent, and the above is an inference merely, it would scarcely be just to attack or criticise this theory.

It is a matter of some importance, however, to the dental profession of America, to more fully understand Riggs' theory, together with his method of practice, and particularly the pathological characteristics of "Riggs' Disease." Can Dr. Riggs be induced to let his light shine through some of our journals? Even a reprint of the paper read, or his remarks before the Connecticut Valley Association, would be welcomed by those who have had no access to the proceedings of the above named society.

As to the best treatment of alveolar pyorrhœa, the case reported to this body by Dr. H. S. Chase, of St. Louis, before alluded to in this article, offers a rational and effective mode of treatment; the main points of which have often been verified in my own practice. With this, or a substantially similar treatment, I should expect not only to benefit my patients, but in some mild cases, even hope to establish a permanent cure.

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DISCUSSIONS.

Dr. Rawls: I have listened attentively, and, I assure you, with much interest, to the paper just read; and I believe the subject merits more consideration than has heretofore been bestowed upon it We see many patients afflicted with this disease that cannot be permanently cured by any of the present modes of treatment. It is true, however, that the disease may be held in check for a time by removing all deposits of foreign matter about the neck and roots of such teeth, and, if necessary, cutting away portions of the alveolar border when it is denuded of its periostial covering. But even this will only effect a temporary cessation of the forces which will ultimately result in a loss of all the teeth.

The disease attacks not only single individuals of a family, but entire families, extending almost invariably through several generations; and in view of this we would naturally infer that it is not a local disease, or caused by local irritants, but on the contrary, a purely constitutional malady intensified by local agencies. In some instances only one or two teeth are affected, and it may be altogether on one surface of the teeth; this would indicate to a careless observer that the trouble arose from foreign irritants, yet by watching those cases you will find that it does not stop there. As the paper indicates, it may indeed cease its ravages for a year or two, possibly ten years, and then pursue its course with more rapidity than before. The disease is undoubtedly aggravated by the deposition of lime salts, foul secretions or fouler excretions about the teeth and their roots. Of course such irritants should be removed under any circumstances, and most certainly when existing in connection with this peculiar disease. It has been termed Riggs' Disease. Now while I do not wish to reflect upon Dr. Riggs, yet I am sorry he put himself on record as he is reported to have done.

DR. ATKINSON: Where has Dr. Riggs put himself upon record?

DR. RAWLS: Before the Connecticut Valley Dental Association he is reported to have made this remark: That for want of a better name he would call it the Riggs Disease. I do not presume that any one will object, certainly I will not, to the Doctor's laying claim to the honor of his peculiar mode of treating such cases; but as to the discovery of this disease as a peculiar disease, it has been brought to the notice of the profession under different names many times, and probably years before he entered the profession.

You will find that some patients whose families have suffered and lost their teeth by this malady, have early premonitions of coming trouble; they insist that they are not likely to retain their teeth long, since so many members of their family have lost their's by this disease; and consequently try to take the best of care of them in order that they may put off the evil day as long as possible. I have under my care the teeth of a family of ten children, and I have examined the teeth of very many more of their relatives, and not one of the number is free from the effects or symptoms of this disease. Many of them have undergone treatment, but none, so far, have been permanently cured.

Dr. Riggs, as I understand him, claims that the disease arises from deposits of lime salts, and other foreign substances, about the roots of the teeth affected, and that these deposits cause denuding of the periosteum, and necrosis of the alveolar border. That these things do occur sometimes, I admit, but that they occur as the primary cause of this Pyorrhœa Alveolaris, as Dr. Rehwinkel terms it, I doubt very much, but agree with the paper that it is a local expression of constitutional disease, and only aggravated by deposits of foreign matter about the teeth.

DR. SHEPARD: I am not quite ready to say anything on this subject, and had intended to wait till others had spoken, but I have listened to so much of misrepresentation, founded, I am convinced, upon nothing but hearsay evidence, and perhaps prejudice, that I cannot longer refrain from the attempt, at least, to defend my absent friend, Dr. Riggs, from unjust accusation. That he has himself asserted that he called the disease under discussion Riggs' Disease, is, I think, totally without foundation in fact.

DR. RAWLS: Do you mean to say that I have no foundation for the statement?

Dr. Shepard: I say without any foundation from himself. That he may have said it in some other part of the country, when I was not present, I cannot, of course, deny, but that he said it in the Connecticut Valley Society, I do deny; and I should be correctly informed, for I edited its Records, recently published, of the thirteen years since its organization in 1863, and have been a constant attendant of its meetings. During an intimate acquaintance of fourteen years I have never heard him give utterance to anything that could bear any such interpretation. That the name Riggs' Disease has obtained with some universality in this country is due to the friends of Dr. Riggs, to his disciples, who have given it that name for the want of a better.

In discussing this subject I hesitate to express my full convictions. Probably each one here feels that he has understood this disease, or, at least, has treated it in the best manner. Such a view is natural, especially in our more successful and leading men. I ask you to throw aside this egotism, and allow me to make the assertion that, apart from the theory and treatment of Dr. Riggs, and prior to his commencement and demonstration of them, this disease was not understood nor thoroughly and successfully treated by any dentist in the land, and that the same is true at this day so far as the great majority of the profession is concerned. It was and is treated in a manner, but not in a thorough manner, nor to the extent of a radical cure. I know something about Dr. Riggs' theory and treatment, have seen many of his cases before and after operation, and have myself had a good deal of practical experience in following his method, but I cannot hope without proper time, to be able to express myself so accurately as to escape criticism. The essayist's experience in trying to get information from Dr. Riggs does not surprise me, for I know how peculiar he is, and how difficult it is to get him to put into writing his thoughts. But I will try and give you some insight into his views as I have had them time and again from his lips.

He considers the disease to be mainly the result of a local cause, namely: the accretion upon the surface of the teeth, at their necks, and just under the free margin of the gums. What is the origin of this accretion and whence it comes, is a matter of some doubt. Certain it is that it differs from ordinary salivary calculus in that it is found not only on the buccal surfaces of the superior molars and bicuspids, and the lingual surfaces of the inferior incisors, but on all the surfaces, labial, palatal, etc., of all the teeth, (regions remote from the mouths of the salivary ducts), and frequently on these latter surfaces without any on the former. That there

may be and probably are causes which are constitutional, he does not deny. He recognizes, or I do decidedly, that the disease is hereditary in many cases. I have two patients, father and son, where the former, about forty or forty-five years of age, had suffered so far as to have had several sound teeth drop out, and all the remaining were loose and sore, with abundance of pus before treatment; and the latter, about twenty-one years of age, had the disease to a less extent, though a thoroughly marked case. (The treatment of the former three years ago, has resulted in a radical and permanent cure.)

He considers that all cases, however advanced, were primarily of the simple nature of that of the young man just mentioned; that this accretion, wherever it gets a lodgment, acts as a local irritant, inducing inflammation of the mucous membrane, a gradual ulceration and absorption of the alveolar process, first of the thin edge, with the production of pus, and so continuing, year after year, getting deeper and deeper, until finally all the bony support of the tooth is gone, the roots bathed, more or less, in pus, and held in place only by the soft tissues, by a sort of ligamentous, so to speak, attachment. The amount of the pus secreted is sometimes very great, as is shown by the fact, that, in extreme cases, it is voided at night during sleep, upon the pillow, to the extent even of a spot the size of one's hand, while during the waking hours, when stimulated by the action of the mouth in talking, mastication, etc., it must be very much greater; that the patient during the day is constantly taking this pus and blood, mixed with the food and saliva, into the stomach, where it produces a serious disturbance of gastric function, with loss of appetite, indigestion, and extreme dyspepsia, resulting in emaciation and loss of general systemic tone, with decided blood poisoning, to the extent, as I have seen it, of purpura upon the breast. From this description it will be seen that Dr. Riggs regards the disease as mainly local in its cause, but that it becomes, in its progress, both local and constitutional.

The general treatment has been by physicians by medication, systemic and with lotions, and by dentists by both medication and the removal, less thoroughly than by Dr. Riggs, I think, of the local irritant. It is contended that two facts have been demonstrated by Dr. Riggs to the satisfaction of those who have watched him for years; first, that medication without surgery, or the complete and thorough removal of the accretion, cannot effect a cure; and, second, that surgery alone, or the thorough removal of the accretion,

or exciting cause, with absolutely no medication, will effect a cure of the disease, arresting the secretion of pus, securing a healthy and firm mucous membrane, the tightening of the teeth, or those not too far robbed of their support, and a recovery from all constitutional sequelæ by the natural processes of a renewed appetite, digestion, assimilation, etc., resulting from the absence of the gastric disturbing pus; or in other words, he has demonstrated that a radical cure is dependent upon surgical treatment, and that medication is only of use as an adjunct to the surgical treatment as a stimulant to rapid recovery, or to render the mouth more pleasant to the patient.

Dr. Rehwinkel: Has Dr. Shepard ever seen a case where all these symptoms were cured without medical interference, and with no recurrence of the disease?

Dr. Shepard: I can only go back to 1865 in my observations of this treatment, so far as that observation extends. I can produce living witnesses of cures effected without medical interference, and with no recurrence of the disease. I will only mention one case. In August, 1872, a gentleman, a merchant in one of our large cities, temporarily in Boston, who had been a patient of one of the most distinguished dental pathologists in the country, was sent to me for the extracton of an aching tooth. He had been for months incapacitated for business, and under medical treatment, without receiving any benefit, and was quite despondent. Upon examination of his mouth I found he was suffering from this disease in an aggravated form, and surprised him by describing his symptoms—the stain upon the pillow, purpura, etc.—without any questions. His disease was so far progressed that I hesitated to operate, and prevailed upon him to go to Dr. Riggs, which he did. After the treatment, taking two days, he went home; his appetite soon returned, his spirits revived, and in six months he was a well man, walking the streets, and attending to his business, and has continued so ever since, with no recurrence of the disease. There was no constitutional treatment, only a thorough surgical removal of the deposit. I do not claim that there are no constitutional affections of the gums; the subject is a broad one, due to other causes, for the cure of which medical interference may be effectual, and with no surgical treatment. We are considering now only this one manifestation, which the essayist has treated of, and which has in some quarters taken the name of Riggs' Disease.

That Dr. Riggs discovered the disease is claimed by no one; or that

he has published such a thorough and scientific description of its origin and pathology as to have his name applied to the disease, is not claimed; but it is claimed that he has originated and publicly demonstrated a treatment for the disease, which many consider so great an advance upon other and former methods, as to have rendered it within the power of our profession to effect a radical cure to an otherwise incurable disease. So if we would be accurate we should say Riggs' treatment of a disease. But the fact still remains that throughout the length and breadth of the land the disease itself was so little thought of, so poorly observed and so poorly described, that there was little known on the subject, and that Dr. Riggs was the first, and almost the only man for years, that stimulated the profession to investigate it. This fact gives him, I think, credit not only for his instruments and his treatment, but credit for the disease itself to a greater extent than would be due if it was not for this fact. And this is the reason why those of us who have been familiar with him and his "one idea" for so many years, who have practiced the treatment and seen its wonderful results, have called this disease Riggs' Disease.

Dr. Corydon Palmer: It is painful to me to see the time of this intelligent body wasted upon this subject. There has been so much said about the wonderful Riggs' Disease. There is not an old practitioner here who will not say that one of the first principles he ever learned in dentistry was to remove salivary deposits from the teeth, in order to restore the gums to a healthy condition. There is not an old woman in the country but what knows that you should take the scurvy from off the teeth when it is discovered. But, Oh, the Riggs' disease! A Frenchman presented his little girl to me to have her mouth examined: "Oh, is it ze Riggs' dizee?" when there was nothing but a little deposit of salivary calculus. It differs only in degree, and it is easy to remove it by a surgical operation, and a cure will be effected. All honor to Dr. Riggs; but this bringing him into notice, with his instruments for the treatment, and giving him the whole credit for it, is too foolish. I don't know what you are thinking about. I don't know where you are. There is not one of you but can treat the Riggs' Disease succesfully if you will do it. The trouble is that you wont do it. There is nothing to be done but to remove the foreign deposit which is getting up the irritation. Let gentlemen be more careful to treat the cases that come under their hands, and be thorough about it, and there will be no cause for making such a fuss about this disease—a thing that has been known since the earliest attempt at the practice of dentistry. I felt that I

could not let this opportunity pass without saying what I have said, because there has been too much valuable time wasted in talking about this thing, and too much fuss made about it.

Dr. Barker: I cannot agree with my friend, Dr. Palmer, that we are spending too much time on this subject, but do approve of a great deal that he has said, and am perfectly willing to give credit to Dr. Riggs for the instruments he has invented, and which can be used for the purpose designed, most effectively. I cannot with my friend on the right accord to Dr. Riggs no responsibility for permitting his friends to present his name in an objectionable manner, month after month, in the dental magazines, and give a title to a disease that he has no more right to than any dental practitioner.

This subject is one of vast importance, and we should not examine it from a strictly local standpoint; in the majority of cases presenting, absorption of the alveolar processes and retro-cession of the gums is due to the presence of tartar, or foreign matter lodged around the teeth, and the simple removal of the primary irritant will, in these cases, arrest the disease; but, in many others the local pathological condition is but the expression of a systemic disorder, and hence the removal of the tartar will give but partial relief, unless supplemented with alteratives and tonics, as iron, quinine, or agents of that character, the tendency of which is to invigorate digestion and promote healthy nutrition, the disease being more or less a simple expression of general mal-nutrition. It presents itself occasionally in the mouths of persons who are very careful of their teeth, and where we can find no traces of salivary deposit, and where alone systemic remedies and hygienic influences can be relied upon, but which, nevertheless, are generally ineffective, the disease being due to hereditary influences transmitted from one generation to another, which no medicine or treatment can control. In one such case in my practice I can remember where many different members of the family, both male and female, were losing their teeth by this disease, and all treatment seemed to be ineffective. The ordinary local treatment is to remove as perfectly as possible, with instruments, all salivary secretions or foreign substances there may be about the teeth, and at the same time introduce into the pocket of the gum, aromatic sulphuric acid, or, what is quite as effective, equal parts of saturated solution of tannin and aromatic sulphuric acid. The action of these topical remedies is twofold: first, it combines with any portion of tartar remaining, which instruments have not been able to remove, thus leaving the teeth clean and free from tartar; second, the preparation acts as a stimulant and astringent to the suppurating

surface of the pocket in the gum, changing the character of the purulent secretion, favoring a plasm-producing surface. Careful attention to this treatment will, in many, produce happy results. In the cases depending on hereditary transmission much good may be expected by the administration of the hypophosphate of lime in solution, particularly in those cases where the tendency to absorption of the alveolar processes is very marked.

I have not viewed this subject in its broadest aspect, and its increasing frequency seems to indicate that it is one of the results of civilization, in consequence of the non-use of the teeth, and the consequent suppression of motion of teeth in their sockets; and as a result nature takes this method of vindicating the universal law of retrograde metamorphosis expressed in atrophy of the alveolar processes, and consequent absorption of the gums. To overcome this tendency, and encourage, if possible, "*reversion to primates*," I urge my patrons, both young and old, to use hard food in their families, particularly the oat-meal cracker and dry toast. As an instance of the value of hard food, look at the Irish who come to this country with clean, healthy, sound teeth, nothwithstanding no use had been made of the tooth-brush; but after a short time in America, as a consequence of eating soft food, they suffer from dyspepsia, salivary deposits with dental caries, and absorption of the gums and alveolar processes, with loosening of the teeth.

Dr. Atkinson: I wish I had time to unravel this tangled net that has been presented before us, for tangled it is in the apprehension of the best enunciators that have been answering the questions put forth in the paper. It is in vain for us to talk about hereditary tendency, and tendency to disease, for all these terms simply mean generalization or groupings together of acts that we do not understand in their individual presentment, nor understand whether they are local or constitutional.

Pathology is so deep, so wide, that it requires a very close scrutiny, a strong mental stretch of attention, a very fine perception of the movement of the round of nutrition and de-nutrition, to understand it at all; and we have been so befogged by superficial investigation—and words have been so bedeviled that they may mean just anything that we please to saddle upon them.

What is this condition? It has been called "abscess," it has been called everything but the thing it is. Not one single man has said "ulcer;" and if we knew what ulceration was and the distinctive difference between

ulceration and abscessing, we should have the whole subject properly before us. What is the reason that it is hereditary? Who knows that? Those men who have followed the cases, claim to know it. Do they understand the significance of heredity? Do they know that it means longevity of the office of reproduction of the elements of the tissues to be replaced for a certain number of times, and then cease to be capable of being replaced? Do they know what I have nominated the "cirsoid line" about all ulceration and all abscessing? It means a general congestion of the capillaries that surround an ulcer or abscess; it is the red line between the healthy and the diseased action. Do they know that if it is not reduced to a healthy tone, or extirpated, you cannot prevent the ulceration going on indefinitely as long as the patient lives? I have had many cases; one that continued discharging pus at intervals for twenty-four years from the effects of devitalized pulp of the superior central incisor; the patient possessed a good constitution, and the case yielded readily to treatment, and has remained perfectly sound and healthy for ten or twelve years.

As to our beloved friend, John N. Riggs, to whom much credit has been given, and at whom, on the other hand, very much unjust criticism has been launched, if he did this before anybody else, he ought to have told it then. It is on record by your speaker of having done this same thing before he left Cleveland, Ohio, (1861), and before he knew Dr. Riggs, other than by reputation. I take the ground somewhat similar to Dr. Shepard; I do not think Dr. Riggs is chargeable with individually or willingly making the claim, but I do think that the charge made by Dr Barker is correct, that he was a little weak-backed in letting his friends say it; he ought to have stopped it as a professional man, as a man sporting an M. D., as a titled man in the profession.

What is the treatment of this disease? They say, "Remove the deposit, and that is sufficient." There is no such thing as exclusive local disease. How do you like that? Constitutional disease, constitutionally expressed in full measure, results in death. Therefore there can be no expression in a living patient cognizable by the very best diagnostician but local expression of constitutional degeneracy. If you understand what I say and appreciate the remark, that provides for the whole in these two forms of deterioration (constitutional and local), which have been presented to us as *one* form, and wholly attributable to salivary deposit. There is a running out of the line of the longevity of the tissues, but the utter nonsense of saying that ten years, and twenty years, and thirty years, are intervals at

which this shall occur at the same location, is apparent—it simply means local disturbance by which such results are brought about. Many times I have seen a chasm by the side of the root, with the alveolar process entirely gone, and the gum in a sort of hypertrophied condition, with the morbid tissue occupying the place where the alveolar plate was, and the gums standing up and looking nearly healthy, but a little congested and blue. If the pulp be living at the end of the root, and the tooth be sound, you need not do anything but clear all the foreign material out, and wash clean with warm salt water (at blood heat), then dry as well as you can, and fill the pocket with aromatic sulphuric acid, being careful not to let it spill over the sides. You are required to get the condition whereby you can secure a state analagous to the embryonic condition before you can ever get an alveolar process reproduced. Whenever you can get a pocket to hold the pabulum, you can have all the tissues of the alveolar border reproduced to the neck of the tooth. Suppose you can get a pocket, you can accomplish a complete cure—any man to the contrary notwithstanding.

Dr. McQuillen: I had the pleasure of meeting Dr. Riggs several years ago, and formed a high opinion of his personal worth and character. I never met with a more modest, unassuming, retiring man; and with regard to the criticism relative to his not taking part in our societies in former years, I have reason to believe it was largely due to his constitutional diffidence; yet at the same time I think he has allowed himself to be placed in a false position. I asked Dr. Rehwinkel why he did not put the clean cut question, he uttered in private to me, "Is Dr. Riggs entitled to the credit of discoving the disease, like Bright, for instance, in discovering 'Bright's Disease of the Kidneys,' or Dr. Rea Barton in the discovery of 'Barton's Fracture of the Radius'?" If that were so, he might be entitled to the credit of dicovering Riggs' Disease. Whether he claimed that himself, or permits his disciples to put the claim forward, he is only in the position in which a large number of the profession place themselves, or allow themselves to be placed. If a gentleman, for instance, invents a little instrument, a chisel, an excavator, or scaler, it is advertised as Dr. so and so's, or Prof. so and so's. Men aspire to a place in the history of the profession, and expect a certain degree of immortality on such a shallow basis as that. It is a vanity we should get rid of; or, at least, when indulging in it not blame others for doing the same thing. I have no disposition to enter into the consideration of the disease itself, as it has been so thoroughly discussed. There is a funous condition of the gum attendant upon this affection, and also due to other causes, which I have removed with the delicate lancet I hold up to

view. I do not want this to be called, however, McQuillen's Lancet. By passing it between incisors or bicuspids where there is a fungous growth of the gum, the growth can be easily cut away. I offer it to you for what it is worth.

Dr. Rehwinkel: I am afraid there is one point in the paper which has been overlooked. In my letter to Dr. Riggs I stated my object plainly: that I was a member of the Committee on Pathology (of the American Dental Association), and as such was preparing a paper treating of diseased conditions of the gums; that I had heard of a resolution of thanks being tendered to him (Dr. Riggs,) by the Connecticut Valley Association, expressive of his claims and merits in discovering peculiar pathological conditions which arose in the disease of the gums *in consequence of deposits of salivary calculus* around the necks of the teeth. I furthermore stated that I inferred from the writings of others that *he* looked upon this disease as of local origin; and he would oblige me by informing me where I could procure anything from his own pen upon this subject, or where I could obtain the Proceedings of the Connecticut Valley Association.

Dr. Mills wrote papers under the title, "What I know about Riggs' Disease (so called)." Now it is safe to suppose that Dr. Riggs knew of these papers; why, then, does he not come forward and define his position and set himself right? Why does he rely entirely upon his friends? I could not criticise, could not admit or deny anything, because I did not know how much he claimed; I do know, only, that some phase of disease of the gums is called by some of us "Riggs' Disease." If Dr. Riggs has discovered any new pathological features in diseases of the gums, we are anxious to know all about it. Then I shall certainly be one of the first to give him credit and thanks for it. It is a subject in which I am specially interested; about which I want to know a great deal more than I do now. I have seen a great deal of it; I have been bothered greatly about it. I have fought it for twenty years, and, it seems to me, without much success.

Dr. Shepard: I have never heard Dr. Riggs call it anything except a species of scurvy of the gums.

Dr. Judd: I want to ask Dr. Rehwinkel if he can tell us where this designation of "pyorrhœa alveolaris" comes from.

Dr. Rehwinkel: It is used to cover this special disease, and no other. This disease, according to my opinion, is a peculiar disease in and

of itself. The symptoms of scurvy of the gums may become mixed up with it, or it may originate in that. It may have a local origin, or it may have a constitutional origin. It is difficult to draw that line—to say whether it is of constitutional or of local origin—because the two blend into one another so, that it is hard to separate them and see where the starting point is.

Dr. Judd: I seldom listen to a discussion with more interest than I have to this; for the reason, perhaps, that when the discussion commenced, I was somewhat befogged and clouded—thought I was listening to a discussion upon a disease with which I was almost, if not totally unacquainted. In the first place, I took the word, or the two words that are at the head of the paper, and, in analyzing them in my mind, attempted to extract some solution from that source. Any one can see, without any effort at all, that the word pyorrhœa comes from the Greek words πυον pus, and ῥεω to flow, and it is used where we have a flow of pus; and that alveolaris comes from the Latin word *alveolus*, and signifies a cavity, and it is used generally with us, always when correctly used, to designate the hole in which the roots of the teeth are planted. I then asked myself the force of this adjective alveolaris as it is used here. I could see that, correctly speaking, it would only mean a flow of pus from the alveolar cavity. I could imagine that the man that first used it intended to spread it over the alveolar process, and that it has been used to designate that condition of disease in which there is a flow of pus from the alveolar cavity, or the alveolar process and the surrounding part. Now, if you take these words at what they mean etymologically, they might signify the flowing of pus from these vicinities; and we have, in the first place, an ulceration of the gums around the necks of the teeth, which is a very common disease, and which is productive of pus, and then this might be comprehended in this term. In children it is sometimes a very destructive disease; and I have seen cases which have gone on until they have resulted fatally. There is a flow of pus here, from the alveolar margin in this case. Then it would likewise cover that condition of disease which we have been accustomed to consider under the head of absorption of the alveolar processes, for I tell you there is a flow of pus in every one of these cases. You see cases of absorption of the alveolar process where to the naked eye you can see no discharge of pus whatever, yet if you place a little piece on a broach, pass it under the gum and rub it over a glass slide, you can see, under the microscope, the pus corpuscles without any difficulty at all. I have tried the experiment, and I have never seen a case in which I failed to bring out pus corpuscles.

Before we pick up a word that is to a considerable extent an exotic here, we had better make use, in describing what we want to describe, of old terms that we have been accustomed to; they are certainly more definite, belong more, in reality, to our language, and generally are more easily understood, and certainly are as useful for all purposes of explanation, as these foreign terms which have been brought into use for the description of this disease. If we do that, instead of bringing a term which could rightfully cover three or four different diseases, we should come down to an accumulation of tartarous deposits on the teeth. It has been almost always treated under this designation, and it certainly expresses the condition of things which we have in the commencement of the disease, and the fact that we have pyorrhœa afterwards is only an accidental matter. When the deposit first takes place, just beneath the margin of the gum there is no pyorrhœa at all. The pyorrhœa is a secondary consideration, and it is only such a result as we always have where we have an inflammation that goes on to the suppurative process. The disease is only a suppurative inflammation. It is true in many mouths there is much greater tendency to deposition of tartar on the teeth than in others. There is, in the first place, a difference in the amount of calcareous solution in the saliva; and then, again, there are conditions in the mouth which determine its deposition. I say these differ very greatly in different mouths and under different circumstances. There is no question about that at all; and there is no question but that, if this condition goes on, and this inflammatory action is continued, and this irritation kept up in the system, you may have constitutional disease of a very serious character; but that it differs from any other disease, any other inflammatory action of the same location, I deny; and I defy any one upon this floor, or anywhere else, to prove that it differs from any other inflammation.

Dr. McDonald: I am neither a friend nor an enemy of Dr. Riggs. I met him in the city of Baltimore a year ago last March, and he described to me his process of treatment, his instruments and what he claimed the result was; and it was simply a surgical operation of removing thoroughly from not only the neck of the tooth, but from all parts of the roots of the tooth, the calcareous deposit. He claimed this deposit was the original cause of the discharge of pus, and when that was removed, ordinarily there would be a healthful action, and a deposit of bone-making material, and restoration of the socket. I understand that the probability is that he has been more thorough in his surgical operations than many of his co-laborers, and that is all that Dr. Riggs claims. He does not claim to have discovered

anything, only that he went down to the bottom of the disease, like a thorough surgeon. He did not claim any particular discovery, to me, with the exception that he had gotten up some very nicely adapted instruments which reach the disease at the lower stratum or at the apex of the root. I ordered a set which I have used from that time to this, with a great deal of satisfaction, and a good deal of success. I believe many of us fail, not only in the cure of that disease, but in many other diseases, because we are not thorough enough.

Dr. Judd: I want to say a word in regard to necrosis of the alveolar walls. In the first place we have been accustomed to speak of necrosis when applied to hard tissue, as the death of bone in mass, to distinguish it from that gradual death which we call caries of bone. This has been the common usage of the term among surgeons in this country from time immemorial, but I have noticed in the last six or eight years that in a good many instances in the German writers, I find them using this term where it relates to death of soft tissues, and I ask the question with regard to what Dr. Riggs meant by the term necrosis; whether he meant that it was a death of the alveolar process giving away in masses, or whether there was an ulceration of the bone, or a caries as Dr. Atkinson supposed, which is the same thing; that is, that caries of the osseous tissues corresponds precisely with the ulceration of the soft tissues. I throw out these words because it might possibly be that Dr. Riggs used this term according to the later German customs.

VOLUNTEER ESSAY.

The Potency of Alcohol to Cause Degeneracy of the Human Teeth.

By EDGAR PALMER.

Studying the influence of this agent only as it affects the organs with which we as a profession have to deal, I am placed upon the border land of a subject a knowledge of which requires a knowledge and explanation of many of those physiological and pathological phenomena which I am conscious of being unprepared to give with as much precision and fullness as I would like, and only expect that what I have to present shall serve as a preface or index to the volume which abler pens must supply.

The methods by which I will attempt to discuss this subject are, first, to prove that alcohol has nothing to do with the nourishment of the organism; second, that when habitually taken into the system as a beverage, or in any manner, to excess, it produces marked physical effects, deteriorating in its influence, and involving the dental organs.

The word *alcohol* I have used merely as a supplementary term to describe that powerful, subtle agent which is contained in all forms of spirituous drinks, and is potent for good or for evil in proportion to the amount of absolute spirit contained, avoiding any allusion to different forms or combinations, or any attempt to connect the mere physical consideration of my subject with any moral or other pathological features. I should

have liked to have dwelt at some length upon the intentional additions of poisonous agents to the alcohol of the various kinds of beverages and modern compounds, for the purpose of showing the increase of evils likely to arise from such introductions, but I leave them, and speak only of the action of the unadulterated spirit.

The living animal body is constructed out of a few simple forms of matter which possess during life the power of motion. Whatever helps to maintain it in perfect order of construction, whatever enables it to move of its own mere will and motion, may be considered as nourishment. The one gives matter and mass; the other gives force and spirit to the mass. Organic chemistry has divided foods into two great classes: those which supply material or tissue, and those which supply heat or other variety of force. Gradually it was detected that the building foods all contained the element nitrogen as an essential part, and that the force-supplying foods are free of nitrogen, and are hydro-carbons—substances that will undergo combustion by oxidation and liberate force for the motive uses of the animal economy. So foods have been for a long time classified as nitrogenous or tissue-feeding, and as respiratory or heat producing; and, so far as I am aware, there is at present no important modification of this view. The nitrogenous foods exist in the animal body in the form of what is called colloidal matter—meaning a jelly-like or soft-solid substance. All the organic parts are constructed out of colloidal substance; every part, including the blood-vessels to their minutest ramifications, is composed of this colloidal material arranged in different forms and plans to suit the design of the part, whether it be a tube like an artery, a bundle of cross fibres like a muscle, or the delicate membranous envelopes and structures; even in the brain and nervous matter there is distributed a colloid. So might I sum up the various parts of the body, and say that all the active masses of structure are nitrogenous and colloidal. In combination with this active matter there are, however, two other material ingredients, viz.: water and saline substance. Upon its combination with water the activity of the colloid depends; upon the saline rests the various kinds of combination of the colloid with the water.

In the human teeth the gelatine is combined with a salt called the phosphate of lime, with carbonate of lime and other salts in much larger proportion than itself, so that in all parts these three material compounds make up the animal structures. Leaving out the consideration of the other animal product, viz.: fat, we have before us the constructive or building parts of the animal body. Excepting the water and salts, they all take

their specific quality from the nitrogen they contain. We know the source of them is the vegetable kingdom, that they are formed by nature in that kingdom, are transferred from the vegetable to the animal, and are not made by any natural process within the animal, and can therefore only be supplied from the one natural source.

Alcohol contains no nitrogen; it has *none* of the qualities of these structure-building foods; it is incapable of being transformed into any of them; it is, therefore, *not a constructive agent* in the building up of the body. Landing, therefore, on the basis of an assumption so derived, we are led to regard the use of such a fluid as alcohol under any of its disguises – except when limited by the skill and learning possessed by the physician—as something superadded to the necessities of life; producing, like chloroform or opium, very marked physical effects when taken into our systems, but which have nothing to do with the nourishment of the organism, or the sustainment of function in any organic part. What, then, is the inference? If alcohol is something foreign and unnecessary to organic life, may it not, when taken in excess, have the power of producing specific pathological phenomena, and which may be definitely traced in its action upon the vascular, nervous, and nutrient supply of the dental tissues, and causing deterioration of tooth structure? I will attempt to answer this question, first, by asserting that *alcohol produces physical deterioration by destroying the integrity of the colloidal matter of which the tissues are composed.* In whatever way alcohol is introduced into the system it enters the blood; and, I will presume that my hearers are quite as familiar as I am with the course it takes in its passage through the body from the time of its absorption to that of its elimination, and will simply mention, in this connection, this peculiarity respecting it when taken into the stomach to be absorbed there from the surface of the alimentary canal: unlike the liquids and foods which nature has provided, it cannot be absorbed until it undergoes a proper degree of dilution with water.

The late Dr. Austin in his researches and observations upon the primary action of alcohol remarks: "Alcohol when separated by an animal membrane from a watery fluid, like the blood, will not pass through the membrane until it has become charged to a given point of dilution with water. It is itself so greedy for water it will pick up from watery textures and deprive them of it, until by its saturation its power of reception is exhausted, after which it will diffuse into the current of circulating fluid." Hence the more we dilute alcohol before drinking, the quicker will it be absorbed, and the

less will be its action upon the blood corpucles by depriving them of the water that holds the fibrine, or the plastic colloidal matter in solution. I have explained that all the organic parts are constructed out of this colloidal material, including the blood vessels to their minutest ramifications, and, in order that these parts should be kept in their integrity in the midst of their diversity, the ultimate structure of which they are composed must be held in proper measure of construction with water. Disturb the relationship that should exist between the colloid and its combining water, and the character of the colloid is at once changed. The fact that the blood corpuscles perform the most important function in the process of nutrition, I need not dwell upon; they absorb, in great part, the oxygen which we inhale in breathing, and carry it to the extreme tissues of the body; they absorb, in great part, the carbonic acid gas which is produced in the combustion of the body in the extreme tissues, and bring that gas back to the lungs to be exchanged for oxygen there; in short, they are the vital instruments of the circulation. With all these parts of the blood, with the water, fibrine, albumen, salts, fatty matter and corpuscles, the alcohol comes in contact when it enters the blood, and if it be sufficient in quantity will modify its function and impede its current to an extent that organs however remote or obscure must feel its influence and succumb to its degenerating power.

These are the only points time will allow me to present relating to the physical action of alcohol upon the nutrient elements of the blood, and I pass to consider, second, its action upon membranous and nervous structures. All the vital organs, and the minutest structures of every organ, are enrolled and enveloped in those expansions of the animal body which anatomists call the membranes. Dislodge a healthy tooth from its socket, and you strip from it its membranous sheath, or the periosteum. Open and examine a healthy tooth and you will find the vascular structure which we call the "pulp" enveloped in what may seem three distinct membranes, and differing but little, save in the strong fibrous structure, from those which envelope the brain and spinal cord. In fact, it is but a vascular structure of colloidal membranes. All membranous matter is colloidal in its functional nature, and not merely mechanical as anatomists formerly held. It is true that the parts and organs are supported and held in their positions in the most perfect order by these membranous sheaths, pouches and coverings; but this is only a small part of their duties. The membranes are the filters of the body; in their absence there could be no building up of structure, no solidification of tissue, no organic mechanism. Passive themselves, they nevertheless separate all structures into their respective positions and adaptations.

When solid food is taken into the stomach it is first resolved in digestion into a soluble fluid before it can be absorbed; in the blood it is resolved into the fluid colloidal condition; in the solids it is laid down within the membranes into new structure, and when it has played its part it is digested again, so to speak, into a crystaloidal soluble substance, ready to be carried away and replaced by the addition of new matter; then it is dialysed or passed through the membranes into the blood and is disposed of in the excretions.

With this description of the important part these membranous structures play in the animal life, I trust I can convince you that the continued use of alcohol exerts upon them a direct perversion of action: First, by so determinately extracting the water from them as to produce in them a thickening and shrinking, and inactivity, which reduces their functional power. That they may work rapidly and equally they require at all times to be charged with water to saturation. If into contact with them, any agent is brought that deprives them of water, then is their work interfered with; they cease to separate the saline constituents properly, and if the evil that is thus started be allowed to continue, they contract upon their contained matter in whatever organ it may be situated, and condense it. Thus, if the delicate membranes which play so important a part in the structure of the dental organs, become condensed, or thickened, or loaded with foreign material, then they fail to allow the natural fluids to pass through them; nutrition is thus cut off, and as a result, there is either an accumulation of poisonous gas or fluid in a closed cavity, like an incipient alveolar abscess, or a contraction and wasting away of the substance of the colloidal membranes, and the life of a tooth so circumstanced, dies; dies as though slowly bled to death.

The modifying action of alcohol upon the corpuscles of the blood, is due also to the capacity of the spirit to extract water from them, and is accomplished in some instances by causing them to run too closely together, or to adhere in rolls; or it may change the round corpuscle into the oval form, or produce other changes, in proportion to the extent of its use, so great as to impair their function to absorb and fix gases, and when the aggregation of the cells is so great, other difficulties arise; for the cells united must pass less easily through the minute vessels of the general circulation, and impede the current, by which local injury is produced. From the distribution of blood in these minute vessels the structure of the dental organs derive their constituent parts. By a refined process of "selection of material," they are supplied with the elements out of which they are constructed and preserved.

Does any one say that the mechanism of the dental organs is so delicate and remote, and the vessels so small as to escape the influence which an undue amount of spirit may exert upon the more vital organs? No! I think it will be conceded that the minute and intermediate vessels of the human teeth are as intimately connected with the construction and with the function of the living matter of which the body is composed, as with any other organ or set of organs in the human body, and are under control of the same organic laws, have the same power of contraction or dilation, and vital force, as the vessels of larger organs, and are stimulated by the same special *nervous action.*

Man has, virtually, two nervous systems—the primary nervous chain and the added centers with their fibres. These two systems, though connected by their fibres in different parts, are yet distinctly separate, both anatomically and functionally. The primary nervous system is called the system of the organic vegetative or animal life, and governs all those motions which are purely involuntary. The centers of the brain and spinal cord, with their parts, are the centers of the motor and volitional and of the reasoning powers, or of those faculties which are under the influence of the will. All those minute blood vessels at the extremity of the circulation are under the control of the primary or organic nervous supply. Now, if from any cause, this organic nervous supply be cut off by interference with the organic nerve feeding that part, the vessels become paralyzed, or at least weakened, and assume a condition of undue tension or relaxation. Moreover, the delicate membranes which envelop and immediately surround the nervous cords, are acted upon more readily by the spirit than the coarser membranous textures of other parts, and thus a combined arrangment of evils affects the nervous matter. Troubles of this kind, consequent upon the perverted condition of the membranous covering of some dental nerve, are almost daily brought to the notice of the dentist; pain caused by an impingement upon a nerve by pressure within the sheath of the nerve, and which in nearly every case has its origin where a nerve is enclosed in a bony cavity.

In conclusion then, in view of what light even these brief and imperperfect researches have brought, I must ask you to believe that alcohol when taken into the system in dangerous excess, so enfeebles the powers of life, so modifies the character of both local and systemic disease, and so changes the action and operation of medical agents, that unless the practitioner of medicine or of dental surgery has thoroughly studied the tem-

perament and constitution of his patient, he is but partially qualified to render his patient any service, and must expect to reap disappointment and loss for his efforts.

But the object of this paper has been, not so much to point out the cause and effect of these phenomena as they may influence the daily practice, as to establish the more solemn fact bearing upon the causes which produce degeneracy of the human teeth. I believe the day not far distant when the wide-spread indulgence in the use of spirituous drinks, and its ravages upon the health and happiness of the people of this country shall be recognized by our profession as among the most alarming causes of transmitted disease affecting the dental organs.

Says an eminent writer: "Amongst the many inscrutable designs of nature, none is more manifest than this; that physical vice, like physical feature and physical virtue, descends in line." And true it is that both mental as well as physical aberrations, inflicted on man by his own act and deed, cannot fail to be transferred to those who descend from him.

Equally true is it that not one of the transmitted wrongs is more certainly passed on to those yet unborn than the wrongs which are inflicted by alcohol. Therefore, how can we expect to reach the acme of dental science without giving heed to these facts in our searchings after that physiological knowledge and thereapeutic light which is to lead the nations of the earth into that era of happiness and blessedness when the teeth of their people shall bear more the evidence of Divine creation than the workmanship of human hands—a millennial epoch when forceps shall have been "beaten into plowshares" and turnkeys into "pruning hooks," and our profession have need to wage war with disease no more.

DISCUSSIONS.

Dr. Atkinson: There is a difference of understanding between the author of the paper and myself as to the functions of the corpuscles as carriers of gases. I know of no gas that a red blood corpuscle carries, but one; hence, when we say gases, we are leading the unwary astray; the essayist is or I am in fault. Oxygen is a gas, and the red corpuscles do carry it by a sort of loose attachment that is hardly worthy the name of affinity—by a loose hanging to the blood corpuscles, and it shakes off gradually as it passes through the body of the vessel in the blood column, becoming dissolved in the serum or carried as gas without being dissolved, as free as oxygen, to the capillary system, where, by the laws of demand and supply, it escapes through the thin amorphous walls of the capillaries into the territory where it is used for purposes of nutrition; that purpose being a production of protoplasm; and combustion which generates the other gas, which is carbonic acid; which the gentleman asserts is taken up by these corpuscles and carried back—he did not say, but I infer that he meant—to the lungs to be exhaled. I ask the gentleman, upon what experiments he bases the statement that carbonic acid is carried by the corpuscles at all? My understanding of the process is, that it is dissolved in the serum as it escapes from the point where it is generated by the combustion of the nutrient act, and then flows as a soluble gas to the system of respiration peripheral or pneumic, that is upon the skin or in the lungs wherever respiration takes place, and thus is exhaled. If I am wrong, correct me. I ask it of you. If you keep still, I will take it for granted that you endorse what I say, but if you understand it differently, and are entitled to call that knowledge, communicate it to me—a hungry brother.

As to the argument with regard to the effect of alcohol, and to the saturation of alcohol in water: these are new ideas to me; I had always labored under the impression that alcohol and water combined in all propor-

tions absolutely—that one drop of alcohol in any body of water would be diffused throughout the entire body, even if it were the Pacific Ocean. If I am wrong in that, correct me; if not, mark one in the progress of apprehension of truth.

DR. BARKER: That is the usual acceptation of it.

DR. ATKINSON: One step further. The statement of the paper is, that alcohol is absolutely innutritious; that it is neither a heat-producing nor a tissue-producing body.

DR. PALMER: I did not say it was not heat-producing.

DR. ATKINSON: You say it was not used in the body.

DR. PALMER: Not as nourishment, but as heat-producing.

DR. ATKINSON: All right, I am after fair, square play, and if I misunderstood you, that is the way to get at it.

My next objection to the statement is, that alcohol does coagulate colloidal material. Colloidal material is only another name for what I call "embryonal mass"—"globular mass"—the protoplasmic nitrogenous substance. If the gentleman acknowledges that alcohol can be combusted in the body, then it is as essential as any other burning material; and if he says it is combusted, I would ask him how the burning is effected. What becomes of the carbon, hydrogen and oxygen that compose the alcohol? He says alcohol is a carbo-hydrate; now, if it were a carbo-hydrate, and that nomination were correct, there would be no O in it, it would be CH. Is there nothing more than CH in alcohol? Do you know of any fluid that has no O in it? That has no H_2O in it? Now the point is this: that the deterioration that is supposed to be transmissable from parent to offspring depends upon a sort of affinity subsisting between the alcohol and the colloidal mass whereby the dialysis or the endosmose and the exosmose activities are interfered with by coagulation of the colloidal mass. I would ask, what is the difference between this form of coagulation and that occurring under the nutrient act whereby the oxygenation produces the coagulation? And are you sure that this amount of thickening or curdling of the colloidal mass is not exactly indentical with that that occurs from the oxygenation of the fat which constitutes the basis of the cell (the vacuole)? And have you accounted for all the alcohol that was taken into the system by any exam-

ination of the excretions of the system? If there is an act that is so nearly indentical with the act of nutrition, which is claimed here to be the result of imbibition of alcohol into the system, are we entitled to say that it is innutritious? If we push the point far enough we can see that a certain measure of alcohol might so curdle as to render this colloidal mass stiff, might interfere with the nutrient processes of the shedding and the replacement of cells. The whole of the secrêtions are simply the shedding, moulting of epitheliun. Then, is not the assertion that alcohol is innutritious, placed somewhat in doubt, somewhat in jeopardy? If it is said that it is a stimulant as opium is, do we know how opium acts as a stimulant? What do we mean by stimulants? Do we mean a catalytic action? Do we mean simply the presence of the thing acting without loss of substance? What we understand by catalysis is the presence of a substance acting to produce a change in the neighboring molecular mass without loss of its own bodily presence.

Dr. Spalding: Without decomposition of itself, without any change in its chemical constituents?

Dr. Atkinson: Yes, without any loss I said, or any cognizable change, according to our present knowledge.

Dr. Spalding: You say loss; what I mean is to include any accretion as well as loss, that the relative proportion of the chemical constituents are not changed, either by addition or subtraction.

Dr. Atkinson: If it is exhaled at all, it is exhaled as pure alcohol, no doubt.

Now then, as to the argument as against the use of alcohol. I tell you I do not believe it. It is the excess of the use of anything that can become a constituent part of the system, that interferes with nutrition. If we had established the point, that the paper states as a fact, of saturation of alchohol and water, then that would be at least one of the legs of the stool of the argument, and we might have the other two put into it, and make it stand, but it topples a little; I cannot see it. The only argument against alcohol is its use in excess; that is the point. There is alcohol manufactured and used in every man's stomach.

Dr. Spalding: Every day?

Dr. Atkinson: Every meal he takes, *nolens volens.* These points are points that sometimes have to be dogmatically stated when we are in the very beginnings of the crepuscular stage of our apprehension—the nine days of our cat-ivity. We have not got the "membrana pupilaris" quite clear yet, which is over our understanding of the law of physiological activity. I wanted to make these statements for what they are worth in the estimation of every listener, for I tell you truth is not sustained or broken down by the vote of any man or body of men. Present the facts and let the juridical mind decide.

REPORT

OF THE

COMMITTEE ON CHEMISTRY.

By J. S. CASSIDY, Chairman

The complicated nature of the reactions that take place by general decomposition of an organized substance, renders detection of individual compounds thus formed extremely difficult. This unfortunate condition especially obtains in the human oral cavity, where traces of nearly all kinds of vegetable and animal matter taken as food, triturated, insalivated, and mixed promiscuously, are continuously present, because continuously renewed, undergoing rapid chemical change, by both fermentation and putrefaction, and in such relatively small quantities as to deter the most patient experimenter from the labor of attempting any definite classification of such innumerable products.

Your committee, however, felt desirous of testing one or two kindred processes, in relation to their action on tooth bone, inasmuch as to these prolonged vicissitudes of change, the destruction of teeth by loss of substance is directly due. The generally, and we think properly, accepted theory of acids being the solvent in dental caries—whether they be formed by influences external to the immediate part affected, or by propagation within an existing cavity—afforded a suggestion as to the nature of some experiments that might be attempted on extracted teeth. Believing that acids, however destructive, taken into the mouth, either as food or medicine, do

not primarily cause cavities of decay, we ignored any effort to ascertain the effects produced by any of these well-known substances, and confined the experiments to more rational, though less pleasant, methods of procedure.

Two cases of teeth were arranged by imbedding the roots in a mixture of plaster and gutta-percha so as to represent the natural position of those organs in the mouth; each case contained two central and two lateral superior incisors, two cuspids, two bicuspids and two molars, selected indiscriminately, but all chosen because of comparative soundness; the molars being intact, having been extracted because of senile absorption of alveoli; the others more or less decayed, though not necrosed (i. e., not devitalized previous to extraction).

In order to supply a cheap, long continued and uniform temperature of about 90° F. to our experiments—as in all cases of so-called spontaneous decomposition of organic matter, a certain degree of heat is a necessary condition—we improvised a liquid thermal bath, consisting of a circular flat-bottomed glass dish partially filled with water, and into this was received two other vessels, also of glass, the latter to contain the reacting substances. Two bottles, the one containing water, and the other sulphuric acid, were placed in position and arranged so as to allow a slow dripping of each into the water beneath. The regular mixing of these two liquids in proper quantities, of course, gains the desired point of temperature; and after exhaustion, the diluted acid may be repeatedly economized, allowing for decrease of energy by occasional renewal of acid in full strength.

Before entering into further details, we will premise that inherent chemical change of organic matter consists of the different kinds of fermentation and putrefaction, and that these processes take place mainly through the influence of heat and moisture, differing in degree and product according to the nature of the bodies undergoing material loss of indentity. In the human mouth the most favorable circumstances are nearly always present for the propagation of molecular progress toward simpler forms. Particles of food, however minute, of animal or vegetable origin, always tend to degenerate into active definite compounds, some, at least, of which, are undoubtedly the immediate cause of certain varieties of decay in teeth. Fermentation generally ceases with the production of its typical acid, and, according to Dr. Geo. Watt, two *mineral* acids are formed by organic decomposition following the first steps of putrefactive change from dihydric sulphide and ammonia, viz.: sulphuric and nitric acids. Of the organic acids most capable of injuriously affecting teeth, and also most likely to be produced by fermen-

tation of vegetable food containing starch, we mention acetic and lactic acids; and to the development of these agents in contact with natural teeth we endeavored to apply our experiments.

Of the various agents by which acetous fermentation may be produced, we selected strong cider, to which was added a small quantity of malt; and for a lactous fermentative was mixed raw sugar, milk, water and putrid cheese, the latter substance being often renewed on account of caseous coagulation by the acid. These two mixtures were placed each in one of the two glass vessels already mentioned, and the two cases of teeth mounted as described, suspended in them so as to remain near the surface, inasmuch as at the surface the acids are developed. Both vessels were then loosely covered and immersed in the liquid bath, care being taken to shut off the sulphuric acid from any interference with the process.

The steps in acetous fermentation may be described in four stages: first, the conversion of the malt (or starch rendered soluble by the diastase present,) into glucose; second, change of glucose into alcohol and carbonic acid—the cider in the mixture answering to the second stage; third, production of aldehyde and water by oxidation of alcohol; and, fourth, oxidation of aldehyde into acetic acid. As represented by symbolic equation:

1st. $\overset{\text{Starch,}}{C_6 H_{10} O_5} + \overset{\text{Water,}}{H_2 O} = \overset{\text{Glucose,}}{C_6 H_{12} O_6}$

2d. $\overset{\text{Glucose,}}{C_6 H_{12} O_6} = \overset{\text{Alcohol,}}{2C_2 H_6 O} + \overset{\text{Carbonic Acid,}}{2CO_2}$

3d. $\overset{\text{Alcohol,}}{C_2 H_6 O} + O = \overset{\text{Aldehyde,}}{C_2 H_4 O} + \overset{\text{Water,}}{H_2 O}$

4th. $\overset{\text{Aldehyde,}}{C_2 H_4 O} + O = \overset{\text{Acetic Acid,}}{C_2 H_4 O_2}$

The reactions in ordinary lactous fermentation depend upon the particular kind of sugar and ferment employed. The change in some cases consisting of the assumption of the elements of water, and in others of the simple resolution of the saccharine molecule, thus:

$$\overset{\text{Milk-Sugar,}}{C_{12} H_{22} O_{11}} + \overset{\text{Water,}}{H_2 O} = \overset{\text{Lactic Acid,}}{4C_3 H_6 O_3}$$

$$\overset{\text{Glucose,}}{C_6 H_{12} O_6} = \overset{\text{Lactic Acid,}}{2C_3 H_6 O_3}$$

Not quite three months have elapsed since instituting the process; a rather lengthy period of time to devote to one experiment, but insufficient

to decide satisfactorily many points in regard to details of analogy in oral chemistry. Before exhaustion of the first supply of the acetous mixture, a greenish film encircled the teeth at the line bathed by the surface of the liquid. There was no solution of continuity visible on any of the teeth, but the dentine lining the existing cavities was considerably softened. No perceptible change on the enamel at the end of five weeks. About that time extracted a deciduous molar from a child æt. twelve years. Its buccal surface, grooved slightly by decay, was covered by the well-known greenish deposit so often found near the margin of the gums on the teeth of children. Two weeks influence of the process on this tooth showed decided evidences of disintegration, especially on the buccal surface. At the present time the crown is tunneled through, the solution following the previous point of decay, the external surface presenting irregular minute patches of softened enamel. The effect upon the enamel of the other teeth has been almost *nil*, indeed, entirely so, except at the necks of the two lateral incisors—where the air and liquid met—at which point there is some manifestation of superficial circular abrasion, sufficient however to safely warrant the opinion that all will ere long succumb to further trial.

In regard to the fact of these teeth offering so much resistance to the action of acetic acid thus developed, we must remember that this agent is almost incapable of dissolving calcium phosphate when organized, even in a dead tooth. Its affinity to lime salts is directed mainly, though mildly, towards

Calcium Carbonate, Acetic Acid, Calcium Acetate,

the carbonate ($Ca\ CO_3 + 2C_2\ H_4\ O_2 = Ca\ (C_2\ H_3\ O_2)_2 + H_2\ O + CO^2$), but it dissolves gelatine and kindred substances with avidity; a property which doubtless explains its relatively rapid operation on the recently extracted deciduous molar.

While acknowledging insufficiency of proof by our experiments, we unhesitatingly submit the proposition, that, when accompanied by greenish vegetation, the white decay at the free margin of the gums so often noticed on the anterior, and sometimes on the molar teeth of children, and, also, not infrequently on the corresponding teeth of adults, is due to acetous fermentation of the particles of starchy food remaining in the mouth. The characteristic greenish deposit seems to be a necessary concomitant to this process, whether as an absorbent of oxygen, or a fermentative vegetation, or both; or whether its growth is a cause or a consequence of the chemical change, we cannot say. It certainly affords a surface more capable of retaining the elements of eremacausis than the clear enamel, and its general restriction

to the anterior teeth is doubtless owing to their extra exposure to the air. Therefore this class of decay is susceptible, over all others, of prevention, and of control in its incipiency, by eradication of the fungous deposit, and subsequent continued cleanliness. The application of a mild alkali, while doing no harm, would effect but temporary good so long as the local– and perhaps predisposing—cause of the fermentative process remains.

A tendency to a recurrence may be counteracted by suggesting dilute acetic acid—vinegar—as a condiment; the therapy of whose action might be explained by assuming as true the dictum of later physiologists, that acetic acid is the principal solvent in the gastric juice; and if long continued lacking in quantity, such derangement may induce an abnormal effort at elaboration of the desired substance in favorably located parts of the month. Hence sufficient supply of the needed substance to the part in need, will, on the apparently homœopathic principle, neutralize the tendency to its unwelcome formation in other parts. However this, by the way, may be, we think we are scientifically safe in the opinion that the kind of decay mentioned is invariably occasioned by nascent acetic acid.

In regard to the effect of the experiment with lactous fermentation on enamel, we find its influence varying, for the time being, according to the resisting density of the individual teeth. Suffice it to say, that on all, there is well marked abrasion, deeper at the necks, and diminishing towards the cutting and grinding surfaces. That lactic acid is susceptible of development in the mouth, we have no doubt; but the peculiar circumstances necessary to its production are so unfavorably situated there, as to rarely supercede the direct disposition of the saccharine disturbance, to pass through the ethyl-alcoholic stage, and on to its corresponding acid.

It is now about four years since the subject of oral electricity has been brought before the profession for discussion, and the earnestness manifested by the few who have investigated the phenomena, commands respectful attention. Prominent in this movement we find the names of Dr. Henry S. Chase, of St. Louis, Drs. J. Foster Flagg and D. D. Smith, of Philadelphia, and Dr. E. W. Foster, of Boston. Recognizing the chemical aphorism that "under the same circumstances, and with the same relations, the same effects always result from the same causes," the affirmative side of the question claims that inasmuch as chemical action is feeble or intense, in a relative degree, according to the electro-chemism of the acting bodies, it necessarily follows that a tooth filled with a substance electrically opposite to "dentos" becomes an active galvanic battery in a fluid capable of acting

upon either. The question may be more briefly and better stated by quoting from a paper by Dr. Chase: "Every tooth containing a plug or stopping is a galvanic battery ready for action, and which is put instantly into action the moment a portion of acidulous fluid touches both plug and dentos. If the plug is water-tight, then the action is limited to the margin of the plug and dentos; if the plug is a leaky one, then, in addition to the points of marginal contact, there is action inside of the plugged cavity at every point where the material of the plug and dentos are in contact."

The theory is further elaborated by the statement that such a battery, once in operation, is not dependant upon acids taken into the mouth for continued action, but developes acid by decomposition of the fluids within the cavity; the office of the filling being that of a conductor, a connecting medium, which renders the electric current possible, or in other words, sets up a difference between the dentos and fluids, which without its presence, would not exist; the intensity, or power for harm, lessening in degree of energy as the material approaches the conductivity of the special tooth.

Such, in brief, is the doctrine, founded, apparently, on true scientific principles. Your committee, however, are not unanimous in accepting it "*cum grano salis*," by reason of the fact that thermo-electric excitation may. as well as electrolysis, occasion the observed perturbation of the galvanometer, With this single reservation we will leave the subject for the present, as we do not wish in the least to detract from the honor justly due our colleague, Dr. S. B. Palmer, of Syracuse, for his efforts in developing what he and many others conceive to be a truth of vital importance to the future of conservative dentistry.

REPORT ON CHEMISTRY.

By C. J. ESSIG, of the Committee.

We submit a brief report upon mercury, and its compounds, as used in dentistry, believing it to be of sufficient importance, inasmuch as we find, upon intercourse with the profession, that certain fallacious ideas are entertained by many of its members regarding the chemical and physical properties of this element, and of one of its compounds, known as vermillion, which, we think, should be noticed by this Association, particularly as we are advised that it is becoming by no means uncommon for unprincipled persons, commencing to practice in new places, in order to prejudice communities against their old practitioners and in favor of themselves, to raise a hue and cry against the so-called evil effects of the mercury compound entering as a coloring pigment in red vulcanizable rubber. We find, also, that many physicians believe that the physiological effects of mercury occasionally manifest themselves merely through the presence of an artificial denture formed of red vulcanized rubber; and quite recently a member of this committee was applied to by a patient who had been under the care of an eminent surgeon for a bronchial trouble, which, not yielding to treatment, was attributed to the presence of an artificial denture of red rubber, in which mercuric sulphide, or vermillion, formed the coloring pigment.

Feeling that our profession may experience no little embarrassment by the promulgation of incorrect theories regarding the use of mercury for dental purposes, not only by unscrupulous persons, but by well meaning men

who are not well informed as to its properties, your committee has been induced to investigate the subject, and beg to announce the result of their experiments.

First, we find that one fallacy which is not unfrequently entertained, even by graduates of colleges, is, that the preparation of mercury used in rubber and celluloid as a coloring pigment is an oxide of mercury (mercurous oxide, Hg O); it is needless to say to this body that that compound of mercury is never used for such a purpose, it being an exceedingly active poison, which, with its instability, renders it entirely unfit for use as a coloring pigment.

Another fallacy, and one entertained by both dentists and medical men, is, that mercuric sulphide (vermillion), the compound of mercury which is used as a coloring pigment in vulcanite and celluloid, possesses active properties, and that the red and inflamed condition of the mouth and fauces, so often met with where artificial dentures are worn, is due to its action. This belief on the part of some members of the medical profession is no doubt due to the fact that old writers on materia medica attributed medicinal properties to vermillion, (Hg S) and, although given in enormous doses, it was finally abandoned on account of the uncertainty of its effects; recent investigations have, however, sufficiently demonstrated that it is inert.

Although well aware that both the late Prof. Wildman and Prof. Austin, of Baltimore, were unable to discover the presence of free mercury in rubber, either before or after vulcanizing, we, nevertheless, thought it best, before applying the chemical tests, to make a careful examination of specimens of red rubber, both before and after vulcanizing, that we might ascertain whether during the elevation of temperature to which the material in its preparation, or during the vulcanizing process, is exposed, any decomposition or separation of metallic from the non-metallic element takes place. These examinations were made by the assistance of one of the most complete microscopes in this country, belonging to the Central High School of Philadelphia, for the use of which we are indebted to Prof. Henry Leffman, of that institution. Some of the plates examined had been worn for years, others were new; no metallic mercury was found, but little crystals of sulphur were observed abundantly upon the surface. The specimens were then placed in various fluids, separately acidulated with citric, acetic and hydro-chloric acids, in order to observe the action of each, if any, upon the

rubber; some were also exposed to fluids simulating the saliva and gastric juice; the whole were then subjected to a temperature ranging from 97° to 100° F for four months, at the end of which time they were again examined by the microscope. and upon the surfaces of those having been exposed to the action of acids nothing was found. The fluids were then tested, first by Reinch's test, without the slightest trace of mercury being discovered. In applying this test to the artificial saliva and gastric juice, the strip of copper, before heating for the purpose of sublimating any mercury that might be present, was found to be coated with a profusion of crystals, which, however, did not decompose upon the application of heat, and were found to be nothing but chloride of sodium. The dihydric sulphide (H_2S) test was then applied, with a like result; and, lastly, the spectroscope confirmed the previous results, although in some of the fluids, into which had been placed lumps of amalgam, traces of some of the base metals were found, but not mercury.

Our experiments with vermillion (HgS), or cinnabar, demonstrated the fact that decomposition could not be effected much below a temperature of 600° F., a point which would be utterly destructive to either vulcanite or celluloid. Neither can this compound (HgS) be decomposed chemically except by exposure to strong nitro-hydro chloric acid; a fact which precludes the possibility of corrosive sublimate ($HgCl^2$) being formed in an artificial denture of red rubber merely by contact with the saliva, as many members of our profession maintain.

Our experiments with metallic mercury, also convince us that ptyalism or the constitutional effects of mercury, is not likely to occur from the presence of amalgam fillings, inasmuch as solution of the element can only be effected by exposure to a strong mineral acid.

DISCUSSIONS.

Dr. Corydon Palmer: Prof. Wildman found free mercury in the vulcanized rubber. I have seen it with a common lens, too, and you can all see it for yourselves. Free mercury does exist in vulcanized rubber. I make this assertion boldly, because I have seen it, unless it was an optical illusion. I did not wish to see this statement pass without contradiction.

Dr. Gardiner: I wish to confirm Dr. Palmer's statement with regard to free mercury being found in rubber plates, as I was present when Prof. Wildman showed it to Dr. Palmer. He always impressed us with the idea that it was sulphide of mercury; that paper said it was the oxide.

Dr. Osmond: I have not been able to find free mercury in properly vulcanized rubber. I have filed it up, and exposed the filings to dilute muriatic acid, and I have never been able to find any free mercury. Sometime ago I met with two plates which had been over-vulcanized. The party who made them was one of those individuals who advertised to put up a set of teeth in four hours. I was told by a party conversant with the facts, that the usual time taken to vulcanize any piece of rubber made by him, was only ten minutes, at a very high temperature. I had seen several plates made by this person which had a very high polish, but were brittle. I found a patient who had been salivated after wearing one of these plates, and whose breath had that peculiar odor which results from the effects of mercury. I took one of these plates, filed it up, and put it in dilute muriatic acid and water, and allowed it to remain for three days. I then tested it with iodide of potassium, and I immediately saw the red iodide of mercury. If the rubber is properly vulcanized, I believe no free mercury could be found.

Dr. Noel: From the manner in which Dr. Osmond conducted these experiments I do not think it follows that there was free mercury in the plates he tested. The vulcanization of sulphuret of mercury, of course, did not obliterate the mercury; it was only changed to some other compound, some other salt of mercury. He might take the sulphuret of mercury from any other source, and, by the action of acids and other re-agents, get back mercury in a metallic state; this, I think, he probably did with the rubber. It is within the memory of many present, that six years ago, when the Association met in Nashville, the action of vulcanized plates in inducing inflammation of the mucous surface was discussed; and immediately after the adjournment of that meeting Prof. Summers and myself conducted a number of experiments with a view of coloring rubber with some other substance, hoping to get a color more nearly resembling the mucous membrane of the mouth. In every case where metallic salts were employed, we obtained an ugly black sulphuret. That which most nearly approached to success was the crude carbonate of zinc, under the commercial name of calamine. Blood-root and other vegetable substances were tried.

Dr. Osmond: It is utterly impossible to decompose vermillion by means of hydro-chloric acid; therefore there must have been free mercury, or an oxide of it, in that rubber, as metallic mercary, or its oxide, is capable of being decomposed by hydro-chloric acid. There was no doubt in my mind, though I did not examine with a microscope, that globules of metallic mercury must have been present in those vulcanized plates, in consequence of the high heat employed, which decomposed the vermillion, which is a bi-sulphide of mercury, the affinity of the rubber for sulphur having something to do with it.

Dr. Judd: The question in this case is not whether there is free metallic mercury in these plates or not, but whether or not the red sulphuret of mercury, when placed against the mucous membrane, will produce an irritation. That is the question which is to be solved, and the question that naturally and correctly comes before this Association for discussion. We are well aware that when gentlemen experiment for the purpose of proving some favorite theory of their own, the experimentation, as a general thing, is utterly worthless. If gentlemen wish to experiment for the purpose of arriving at the truth, let them conduct their investigations with their minds unbiased as to what is to be the result, and then there will be some chance of their carrying them honestly and faithfully through, and arriving at correct conclusions. Otherwise they are liable to run into all ridiculous

extremes and absurdities. I have heard of experiments having been entered into within the last year, and reported before a dental society, which went to show that corrosive sublimate was a perfectly inert substance. So now we are made to believe that this red sulphuret of mercury is a perfectly harmless substance. If you wish to make any experiment with this, take a spoonful of it in your mouth and keep it there for an hour, and see whether it will produce any effect on the mucous membrane of the mouth or not. It has been stated that it could not produce any effect because it was insoluble in the juices of the mouth. Arsenic is insoluble in the juices of the mouth in about the same degree, but if any of you desire to experiment with this substance, take a spoonful of arsenic in your mouth and hold it there for an hour or two, and see whether it will produce any effect. I simply want to protest against these insufficient experiments. They do not amount to anything. They lead us into absurdities.

Dr. Friedrichs: As far as my observation goes, vulcanized plates do not produce any more irritation than any other plates. Now the question I wish to raise, in view of the fact that there are over a million of plates made of rubber, worn in the United States, is, whether the few cases of disease that are attributed to, and claimed to have been caused by the wearing of rubber plates, do establish the fact of the poisonous effects of the bisulphuret of mercury that is used in the coloring of rubber plates?

Our text books show that the bisulphuret of mercury is entirely inert in its unaltered state; in fact, the metal itself is considered inert, and it only becomes poisonous when in combination with other substances, such as oxygen, chlorine, etc.

I am not an advocate of vulcanite, and make no artificial plates, although it is done at my office, but at the same time, I claim that a report of a few cases of disease supposed to have arisen from wearing rubber plates, is not sufficient to counterbalance the benefit that is derived from the use of vulcanite, nor does it prove to my mind that vulcanized rubber is in any shape or manner a poisonous substance. If it was, we would be in duty bound to ourselves and our patients, to have nothing to do with it.

REPORT OF THE COMMITTEE

ON

DENTAL THERAPEUTICS.

By C. A. BRACKETT, Chairman.

In attempting to present a report upon therapeutics, the chairman of your commitee labors under a number of embarrassments. A combination of circumstances connected with personal affairs has prevented the devotion of as much time as would have been chosen, to study, investigation, accurate observation and record. The same causes have, also, debarred, in a measure, from that frequent association with other practitioners, both privately and in dental meetings, from which much might have been gathered concerning the experiences of others. Again, there is danger of sins of omission from not having at hand complete files of all the periodical literature of the time that has elapsed since the last report. Feeling all this, there was published in the July *Cosmos* a request that anything new in means or methods relating to dental therapeutics be brought to the attention of the committee for incorporation in this report. Quite a number of personal and epistolary inquiries have, also, been addressed to practitioners of acquaintance; but from none of these, nor from the general invitation, has any contributing response been received. With this explanation the meagre gleanings made are respectfully submitted.

In *Johnston's Dental Miscellany* for March, 1877, Page 90, Dr. H. L. Sage, of Bridgeport, Conn., offers testimony to the power of carvacrol in relieving the sensitiveness of teeth much worn down. In a case where nearly all the teeth had come into this condition, the superior incisors having lost half the length of their crowns, their cutting edges and the grinding surfaces of the molars, being excruciatingly sensitive to thermal changes and contact with saline, saccharine and metallic substances, carvacrol in full strength was applied for one or two minutes, with the effect of immediately and completely relieving the sensitiveness. This treatment was made two years before the case was reported, and during that time there had been no return of the sensitiveness. Dr. Sage further testifies that the use of carvacrol in close proximity to the pulp, or even in actual contact with it, does not in the least endanger its vitality, and cites cases in proof. The experience of your committee, while not in every case securing the magical effects described by Dr. Sage, has tended to show that carvacrol possesses valuable and safe obtunding properties, and, that in it, we have an added resource in the treatment of many cases, troublesome both to patient and practitioner. For the alleviation of the pain of preparation of sensitive cavities, carvacrol seems to be fully as effectual as any of the essential oils or their combinations. The odor of the drug appears to be the principal objection raised against it.

During the year several suggestions have been made concerning the relief of sensitiveness of dentine by the attainment of more nearly perfect dryness of the cavity. Dr. Flowers, at the eighth annual meeting of the Pennsylvania State Dental Society, stated that he had for years used with success a small piece of pumice-stone heated and placed in the cavity, sometimes re-heating and re-applying several times. The report of Dr. Flowers' statement is to be found in the December, 1876, *Cosmos*, Page 653.

Prof. T. C. Stellwagen has suggested in the *American Journal of Medical Sciences*, April, 1877, and in a paper before the Odontographic Society of Pennsylvania, April 4th, 1877, published in *Johnston's Dental Miscellany*, April 1877, Page 155, a new cautery, and its application in general surgery, and particularly in sensitive cavities not approaching the pulp. This, though efforts are making by the inventor to improve it, consists of the hot ash and coal on the end of an ignited stick of compact wood. Of its use Prof. Stellwagen says: "It may be well for me to explain that the ash of the wood being ant-acid and warm, I presume effects the neutralization of the fluids, and the dessication of the dentine; while the crushing of the ash and charcoal into the cavity enables the operator to easily reach

the floors of fissures, undercuttings, or irregularities of contour. Finally, the effect may be much improved by gradually increasing the heat until the incandescent coal of fire itself may be momentarily applied, at first to limited surfaces, and eventually crushed into the cavity, thus spreading over all the inequalities of the floor and walls." With this treatment this member of your committee has had no experience.

The galvano-cautery has been tried for the obtunding of sensitive dentine; but, owing to the expense, difficulties and dangers of its application, will probably never be very largely used for this purpose. Several proprietary preparations for sensitive dentine have been brought out; but your committee has not learned that any of them possess sufficient merit to entitle them to notice.

In a report on Dental Therapeutics, and also in Dr. Palmer's report on Dental Chemistry to this body last year (Transactions 1876, Pages 125 and 106), allusions were made to the use of hypophosphite (hy*po*, not hy*per* as erroneously printed,) of lime, as suggested by Dr. E. W. Foster, of Boston, for the prevention of sensitiveness and its frequent serious *sequelæ* following the introduction of metallic filling. I wish now to state that the year's added experience has served only to corroborate the good impressions then recorded. I believe I have used the preparation in no instance without benefit, while in the great majority of cases in which it has been severely tested, there has been no after-sensitiveness whatever. In one of these marked cases, the lady had almost invariably suffered much from thermal changes for weeks, and sometimes for months, after having had gold fillings inserted. She had lost the pulp of the left superior first bicuspid in this way from a mesial filling in a cavity that lacked considerable of exposing it. Her teeth have remained very sensitive to the excavation of cavities; but, in no tooth in which the hypophosphite of lime has been used, has she had any after-sensitiveness. Without going into chemical theories at all, the mode of its use may be simply stated. For convenience of application the saturated aqueous solution is generally employed. The cavity being prepared, and shielded from the ingress of other moisture, is bathed with the solution, which should be allowed to remain undisturbed for some minutes; then that portion of the water which has not evaporated may be aided to do so with the warm air syringe. This leaves a thin incrustation of the lime salt over all the surface which the solution has touched. Dr. Foster claims, also, that chemical union has probably taken place between the hypophosphite and the contained

substance in the dentinal tubuli—a union which looks toward the more complete calcification of the dentine, and the consequent insulation and protection of the pulp. The little layer of lime salt crystals should be allowed to remain in the bottom of the cavity, but be carefully scraped away for a little distance around the borders, as, if left there, direct adaptation of the filling to the walls of the cavity would be prevented, and thus the foundation be laid for destructive leakage. In all cases of merely sensitive dentine, and in a large proportion of cases of sensitiveness from proximity to the pulp, gold may be introduced immediately upon the lime with assurance that all will be well. In case, however, of approximate exposure of quite a portion of pulp surface, it is prudent to supplement the lime with a layer of gutta-percha, or some other insulator. In cases of complete exposure the hypophosphite appears to serve admirably as a pulp capping. The pulp being in a condition for that operation, the cap is conveniently made of a little mass of the levigated crystals, with just water enough to hold them together. This may be gently pressed into place, and surplus moisture absorbed with bibulous paper. Gutta-percha from the chloroform solution may follow it, and all, or the lime alone, may be covered with oxychloride as an unyielding bridge upon which to build the gold. I have thus given Dr. Foster's use of the hypophosphite of lime somewhat in detail, and perhaps exceeding the bounds of strict therapeutics, because I believe that the treatment is not now generally practiced or well known, and because my experience has led to the conviction that it has great merit.

Concerning the treatment of the dental pulp generally, more rational ideas are gaining ground. Our thinking men do not look upon the irritated and aching pulp as an offender to be soothed with all manner of other irritants, escharotics and caustics. It is generally believed, also, that the peripheral pulp cells are the ones to which we must look for the production of the coveted secondary dentine, and, that if they are destroyed over the surface of exposure the chances of permanent conservation of the pulp are very greatly lessened, even if not taken away altogether. Milder remedies, less heroic treatment, non-irritating, or only slightly irritating cappings, are more and more gaining deserved favor.

At the December, 1876, meeting of the Odontological Society of Great Britain, (*Johnston's Dental Miscellany*, February 1877, Page 73,) Dr. Joseph Walker presented by request a paper "On Treatment and Extraction of the Tooth Pulp." A point upon which truth was sought to be brought out, both in the paper and subsequent discussion, was the manner of main-

taining an arsenious application in contact with the pulp during devitalization in such a way as to have it nearly or quite painless. The essayist advanced the idea that very much depended upon having the arsenious acid as finely triturated as possible. His manner of application was to moisten the apex of a wool cone with creasote, dipping this in the finely powdered arsenious acid, taking up the requisite quantity, and then in acetate of morphia. The morphia is thus first presented to the pulp tissues, in the plan that its effect preceding that of the arsenious acid may render the latter painless. Mr. Hutchinson maintained (*Ibid* Page 76,) that painless devitalization was best accomplished with a combination of arsenious acid with carbolic acid alone. On a piece of blotting paper he placed one-twenty-fifth of a grain of dry arsenious acid, and upon it poured one drop of Calvert's No. 1 carbolic acid, deliquesced. In a few moments a small, solid, easily-manipulated mass would be formed. Mr. Hutchinson claimed that this would not only devitalize the pulp painlessly, but that it would stop the pain if the tooth was aching at the time of its application.

In the July, 1877, *Cosmos*, Page 339, Prof. Flagg, in his work "Dental Pathology and Therapeutics," states that during the past year he has been using an arsenical paste in which oil of cloves is made the vehicle. The theory is that an escharotic effect is undesirable in the paste, as the taking up by the pulp of the greatest possible quantity of the destructive agent would thereby be hindered. The oil of cloves is used as being a non-escharotic, while possessing valuable pain-obtunding properties. Dr. Flagg testifies that his limited experience thus far with the paste so made leads him to advise others to try it. His formula is:

R

Ars. Acid,	grs. v.
Morph. Acet.	grs. x.
Ol. caryophylli,	gtt. x.

M

So far as your committee knows, it is not now claimed that any of the various liquids used in making pulp pastes are true solvents of the arsenious acid. That the mixture is mechanical only, is the basis of the first of four propositions which Prof. Flagg lays down in the May, 1877, *Cosmos*, Page 228, concerning arsenical applications to the tooth pulp. The second, third and fourth propositions are to the effect that with properly made applications in fully formed permanent teeth there is no danger of apical penetration and consequent peridental irritation from the arsenous acid itself, no matter how long it may remain. In support of these propositions Prof. Flagg states (June, 1877, *Cosmos*, Pages 285-6,) that his records show that in more than a thousand cases he has left arsenical applications in teeth, for

periods ranging from four days to two weeks; in at least a hundred cases from two months to six months, and in one case, an inferior bicuspid, (August, 1877, *Cosmos* Page 393,) for one year and three days, without any arsenical impression beyond the apical foramen in any case.

While the experience of your committee, so far as it has gone, has been corroborative of these positions of Prof. Flagg, it may not be amiss to remind the inexperienced that in arsenious acid they have an agent of immense power for evil as well as good, and that carelessness in any respect should never be allowed to have anything to do with their use of it.

At the meeting of the Odontological Society of Great Britain, to which reference has previously been made, Dr. Walker (*Johnston's Dental Miscellany*, February, 1877, Page 78,) stated that he found the devitalized pulp very much more readily extracted if the arsenical preparation was replaced after twenty-four hours with tannic acid in combination with creasote or carbolic acid; the coagulating action of the tannic acid rendering the pulp tissues so dense and firm that they might often be withdrawn almost if not quite entire. Prof. Moffatt, of Boston, and others, take advantage of the same property of tannic acid by using it in connection with creasote or deliquesced carbolic acid upon cotton for the permanent filling of pulp canals in some cases.

In the November, 1876, *Cosmos*, Page 582, Dr. J. N. Farrar, of Brooklyn, N. Y., has a short article entitled "Radical Treatment of Alveolar Abscess." The principle of the treatment is the destruction of the abscess sac by filling it with an escharotic liquid like creasote or aromatic sulphuric acid. This, not always otherwise easily accomplished object, he attains by the use of an instrument resembling a hypodermic syringe. The fine point is carried into the pulp canal and the piston is slowly and steadily forced down with a screw till there is evidence that the sac is reached in all its parts with the injection. If one does not choose to use the medicaments suggested by Dr. Farrar, the instrument, with or without the screw attachment upon the piston, seems well adapted to reach the diseased parts with whatever may be desired to be carried to them.

For bad, chronic cases of alveolar abscess, in which a large mass of morbid tissue has been formed, the dental engine, with a coarse, sharp burr,

is an effectual means of breaking up the diseased action. Among those who have followed this plan successfully is Dr. F. Searle, of Springfield, Mass. He prefers, usually, to accomplish the operation with the patient under the influence of nitrous oxide, and uses as a subsequent dressing:

R

Acidi carbolici,	grs. xii.
Camphoræ,	grs. xxv.
Olei Oliviæ,	oz. ss.

M.

The first excitement over salicylic acid has subsided; but unlike many of the new medicaments which blaze for a brief time only to sink in darkness, this agent seems to really possess in a good degree the properties claimed for it when it was introduced to notice. In the treatment of foul pulp canals it is of much service; and it makes a neat and effectual prescription for the bad-tasting mouth and fetid breath arising from wounds in the oral cavity that do not heal by first intention. In some localities physicians are using salicylic acid systemically in rheumatic and other affections with much satisfaction.

For the control of undue hemmorrhage the use of hot water has lately been suggested; of its merits I have not learned from tests in practice, nor do I know by whom the suggestion was made.

In the treatment of recession of the gums and absorption of the alveolar processes occasioned by salivary calculus, your committee is glad to see the methods of Dr. Riggs, of Hartford, Conn., becoming better known. Personal experience and cognizance of the results of this treatment thoroughly convinced me of its surpassing merit some years ago, and the tests of the intervening time have only served to show its excellence more clearly. It is to be regretted that few, if any, practitioners are able from natural dexterity or printed instructions, to use the instruments as their inventor intended they should be used. Clinical demonstration, supplemented by pains-taking practice, appears to be the only way in which the necessary manipulations can be acquired.

During the past year, as in nearly or quite every other year since the introduction of anæsthetics became general, there have been deaths under the influence of these agents. To discuss these in this place with anything

like the attention which their importance deserves, would prolong this paper far beyond the prescribed limits. It is closed, therefore, with the simple statement that these deaths are justly exciting among thinking men a disposition to avoid the administration of such powerful agencies for any except the severer operations; while they are engaged in investigating as thoroughly as may be, all the conditions and circumstances under which the fatal results occurred, in order that no discoverable fact having a bearing or an influence in such things, may be unknown or disregarded.

REPORT ON THERAPEUTICS.

By FRANK M. ODELL, of the Committee.

The term therapeutics comes from the Greek δεραπευτικοϑ—curative, or that which pertains to the healing art; from δεραπεα—to nurse, to serve, to cure: From which we deduce that therapeutics is that part of medicine which treats of the way of curing disease; and, in its more extended signification, it treats of the symptoms, the conclusions to be drawn therefrom, the power of nature, and how far *it* may be relied upon for the correction of pathological condition, of the mode of treatment to be adopted, and of the different systems of practice which have acquired reputation. With some the term is also used to indicate the *modus operandi* by which the action of medicine is manifested.

Whilst Prophylaxis would indicate the art of preserving health, Therapeusis would be the art of restoring it when lost; or, to speak more exactly, when dominated by pathological activities. According to this definition, Therapeutics is a science of such boundless extent as to embrace all the collateral branches of the science and art of Medicine. Therefore, whether treating of Iatrology, Histology, Biology, Physiology, Pathology, Botany, Materia-medica, Toxicology, or even of Geology, Mineralogy, Conchology, Ichthyology, Ornithology, or a host of other ologys, alogys, and isms, to show that the former practices of physicians, or their classification of, or manner of employing remedies, that the histogenesis or biolysis of tissue, that the normal or abnormal manifestation of function, that the principles, or mechanical, electrical or catalytic effects, to be derived from inorganic

matter in any of its infinite varieties of presentation, in either the body to be treated, or in that from which the substances or effects to be employed are derived, or are proposed to be derived, whether founded upon fancy or fact, hypothesis or demonstration, empiricism or science, has the slightest bearing upon the history, morbid anatomy, ætiology, diagnosis, prognosis, or treatment of a pathological condition, is to prove the position of the essayist entirely within the bounds of his subject.

As it would be an absolute impossibility on an occasion like the present to fully consider all which the term therapeutics embraces, and being absolutely without advices from the chairman of our committee as to what portion of the subject would constitute his theme, or that of the other member of this committee, I have deemed it best to devote my attention to such general survey of the field, that my paper might serve as a preface to whatever the other gentlemen might choose to write.

To enter upon the proper consideration of my subject without further digression, I would say: A wise and gentle therapia would demand from the medical practitioner thorough investigation and consideration of each case. From a carefully ascertained previous history, (due allowance being made for the veracity of the narrator, in connection with his circumstances and surroundings, and the peculiar malady under which he may be laboring,) deliberate and unbiased inspection, aided by the various appliances of modern diagnostic investigation, from palpation and percussion, to the thermometer, stethoscope and sphygmograph, he will be enabled to form a fairly accurate diagnosis and prognosis of his case. The therapeutical management thereof will then be governed in great measure by the empirical or (to say it more softly,) clinical experience of himself, his teachers and confreres. Here, however, thanks to the modern system of recording cases, together with the light afforded by modern physiological research, in experimentation upon the lower orders of organized beings, as likewise to the flood of illumination which has been shed upon what was purely conjectural and occult by that wonderful little instrument the microscope, he can act with some degree of scientific ability, even in cases which may be new to him; and, he should never lose sight of the fact that *the ætiology of a diseased condition gives the best indications for treatment;* nor of that other fact, which cannot be too often enforced upon the attention of the busy *practicien*, that nature unaided is frequently the best physician; and that the duty of the medical attendant is oftener to simply remove the more prominent obstructions to function (by which I would indicate pain, pyrexia,

œdema, dyspnœa, failure of heart-power, cyanosis, or other urgent symptoms threatening immediate dissolution), and then patiently to watch and wait, in order that the natural forces may operate, than to write prescriptions or to administer medicines. To do nothing is frequently the best therapeutics!

The most manifest indication in the application of therapeutical measures is upon the principle of counteracting starvation. The oft quoted passage, "Man cannot live by bread alone," is ever exemplified in the treatment of pathological condition; impaired function in any organ, or congeries of organs, induces direct starvation of certain of the fluids or tissues necessary to physiological continuity. Hope, faith, serenity of mind, cleanliness, disinfection, quiet, time, rest, sleep, in short, any and every measure promotive of assimilation and normal tissue-metamorphosis, are most potent therapeutical measures.

Promotion of elimination and excretion is the first step towards resumption of the normal processes of assimilation and nutrition. Not only must the cells composing the various glands and tissues, when they have fully completed their developmental condition, be cast off in order that the assimilative processes may be continued by their successors, but their contents must be liberated by disintegration of the cell-walls, in order that each specific product may functionate. Again, the necessity for the secretion of products of these various glands and tissues is not greater than the necessity for excretion of their various components from the general circulatory current. And herein lies the most wonderful exhibition of the economy manifested in the ordinary processes of nature; in that those products of histolytic change, which, remaining in excess within the circulation, would result in speedy dissolution of the organism, excreted by the various emuentories of the body, at the proper time and place, subserve repeatedly the purposes of the system, in the facile removal of egesta, and in the preparation of ingesta for assimilation and consequent nutrition. To this end, water (which is eliminated by so many channels of the body—the skin, the lungs, the kidneys, the bowels,) is usually the first, last, and greatest of therapeutic agencies. True, even water may be the chief factor in pathological states (as in asphyxia, by submersion, or in œdema under its various appellations of anasarca, hydrocephalus, ascites, etc., according to the locality overburdened therewith; states readily induced by imprudent exposure, or acute congestion of kidneys, lungs, etc., whereby, instead of normal elimination, we may have extensive storage of fluids in the areolar tissue), but these are not diseases, in themselves considered, but only unpleasant mani-

festations of deprivation of oxygen, or inadequacy of functional activity when portions of the organism are overtaxed; and, in the majority of œdematous difficulties, the norm would most readily obtain, by administration of additional water, *iced*, while the patient was undergoing that most delightful therapeutic measure, the Turkish bath. As an adjuvant to other remedies, in many instances *aqua ad libitum* makes all the difference between success and failure in therapeutic practice.

Fluidity is *the* condition under which the action of the various vital currents remains a possibility; and the absorption and excretion of water is a principal means for the removal of histolytic products. Many so-called diseases, the direct consequence of an excess of nitrogenous waste, are not diseases *per se*, but simply overaction of certain organs in the endeavor to maintain the integrity of the system—vicarious action. The plain indication in such cases is, First, to reduce the consumption of nitrogenous food; Second, to give large draughts of fluids (in order to assist the natural processes, by dissolving and washing out the accumulated salts); Third, to do nothing to prevent excretion from glands acting vicariously—which is simply nature's mode of cure—excepting by deobstruent efforts which shall restore the excretions to their proper channels, and by restoration of systemic tonicity.

In very many instances, tonics, so-called, do not prove to be tonic in the least when administered pure and simple, but combined with specifics counteracting deleterious material within the circulation, their effect is very soon beneficially apparent. We are rapidly returning to a consideration of the propriety of the ancient empirical practice of purgation and diuresis, as a preparation for treatment; this being one of the easiest and quickest methods of spurring the clogged glands to renewed effort, and unloading the circulation of material which has now become *debris*. But the subsequent therapeutical effort has very greatly changed for the better; and the skin is now one of the first of the emunctories to which remedial measures are addressed.

As this subject opens before me with a limitless and ever vanishing horizon, and as I have, doubtless, already exceeded the prescribed limit of time set apart for each report, I will perorate as follows:

Habits of cleanliness, good ventilation, abundant supply of good food, properly prepared, imbibition of a goodly quantity of fluids, orderly and timely attention to the various demands of the system, which necessarily

implies regulation in both time and quantity of food and exercise taken, as also of the alvine and urinary dejections, and full satisfaction of the systemic demand for sleep, (taken at proper intervals), a persistent cultivation of that love for the neighbor which is a mainspring of a contented mind, together with an intensity of application to some regular pursuit which shall leave no time for ailments, are measures both prophylactic and therapeutic, which cannot fail with most persons, and to which the dentist is not a special exception, of a result which might *a priori* be predicted: the greatest measure of earthly happiness.

DISCUSSIONS.

Dr. Atkinson: It is refreshing to hear such a paper as that, to one who has labored long and worked the power to diagnose and understand the operation of what we call disease and the applying of remedies. I must say that it is the best correlation and statement, of the nature and foundation of disease, and its treatment, that I know of. I never heard a paper that I could not pick to pieces and find fault with before. So much for Odell's paper. I have made a few notes on the paper of Dr. Brackett. I am a little mixed in my recollection, and that was the reason for my wishing each paper to be discussed before others were read. It is almost impossible for the intellect to be so clear as to be capable of catching the points brought out by different papers and afterwards to attribute them to their proper sources and discuss them in their order. Hence, I will pass from the

review of Dr. Brackett's paper, because I would not do my beloved friend any injustice; but I would like to have the points corrected. There was a reference made to sulphate of mercury as being present in red rubber. I wish to give you my best apprehension of reading and observations that I have had upon that subject, and I will sum it up by saying that it is called the red rubber disease, or the bi-sulphide of mercury disease.

Dr. Taft: That was in the paper on chemistry.

Dr. Atkinson: It is therapeutics, anyway, if we cure it. I remember now, it was in the other paper. In the first place, I never have seen a case myself, nor heard one detailed, where this sloughing tendency of the mucous surface, and the sore mouth that is called the rubber disease, or the sulphide of mercury disease, was present, that was not dependent upon a peculiar susceptibility of the constitution of the individual, as learned by the history of the patient's experience, and by the results of the treatment afterwards. The moderate form of the disease I do not attribute to the presence of bi-sulphide of mercury at all. I attribute that to the closing of the mucous follicles, which prevents the normal exudation by shedding of the epithelium, preventing normal formation of mucous secretion, and that may occur under any plate. Whether it occurs oftener under rubber than under other plates, I am not informed. The greatest objection I have to rubber is what seems to be the tendency to induce wasting of the alveolar ridge, and even the palatal portion of the superior maxillary bones, when such plates are long worn. I have never seen a case that did not present this condition to a greater or less extent. I have seen cases that when the subject died and the head was dissected, there was no ridge, and only a noduled mass of calcified material here and there, standing out under a fungoid growth of gum, and the palatal plate perforated, perfectly riddled. That is a terrible condition of things; and if such be the result of the wearing of rubber, either the native or the vulcanized rubber, or from the sulphide of mercury in it, we should know it. I have seen loose, flabby gums that were apparently healthy, entirely deprived of the bony base, so that they were as limp as the soft tissues, and ultimately the patient succumbed to a sort of marasmus that we did not then know the origin of. I never have seen that under metallic plates of any kind. But the second form that I have spoken of, I have seen under metallic plates, and even under what I consider better than all, the continuous gum with platinum base. I merely mentioned these points, and confess my ignorance of the source of the malady; and name these as facts, that certain grave conditions

are seen under rubber that are not seen under any other kind of plates. This subject was under discussion and close observation in Europe, and has been reported in European journals, where a committe of the Odontological Society of Great Britian made investigations regarding it. They reported that, as far as they knew, the bi-sulphide of mercury is *nil* in its action. We heard more nearly what I accept as intelligent views upon that, from Prof. Judd this morning—that there is the action by presence, and by very slight solution. But there was one criticism I want to make upon his remarks, in that regard where he instances the similarity between arsenic and bi-sulphide of mercury. You cannot have action by catalysis from arsenic. A little of it must be solved to take hold of the tissues and convert them. It cannot be escharotic without solution and combination with the albuminous part of the tissues.

Dr. Judd: I have but one word to add upon this subject, and that is in regard to the condition found under rubber plates. I wish to state that I have seen two or three cases in which part of the plate was made of black rubber, and the other part of red rubber; and in these cases, the disease was perfectly and clearly marked under that portion composed of the red rubber, while under the black rubber there was no disease apparent. And I have seen perhaps fifty cases in which the disease was present where the red rubber plates have been worn, and on being succeeded by those of other material, the mouth speedily recovered.

I wish to make one single remark with reference to a subject that struck me while the former paper was being read, and that is in relation to the therapusis of cases where the pulp in a tooth is uncovered. I want to present before this association the steps that are necessary to be taken by nature in order to bring about a full recovery in such cases. Now it has been shown very plainly by my friend, Dr. Black, that in many cases where the pulp of a tooth is uncovered, the attachment of the odontoblastic membrane to the hard tissue is stronger than it is to the soft tissue beneath it, and when the hard tissue is removed, it removes—in many cases at least—this odontoblastic membrane Then, you see, we have a loss of substance in the pulp itself, and in order to have a complete restoration to health, we must have a restoration of this odontoblastic membrane likewise; and especially, if we expect a restoration of the bony tissue, because these odontoblasts are the factors by which this bony covering is formed, or through the influence of which it is formed. Now the question arises, is it possible to restore this odontoblastic membrane? In the first place we

have an authority or two from great men, that bears directly upon this subject; one of these is Billroth and the other Rindfleisch, the two greatest men known to pathology to-day, perhaps, in the universe. It is the opinion of the latter that epithelial cellular structures sometimes arise from the connective tissue cells. On the other hand Billroth distinctly states that it is his opinion that they are never formed from the connective tissue cells, but only from cellular cells of the same kind. In order to understand this perfectly, we must take into consideration the fact, that at the time Rindfleisch wrote this, and incorporated it in his great work, it was not known that epithelial cells transplanted from one location to another and placed upon a raw surface, would spring up and grow. That fact has been brought out since, and, inasmuch as he had sometimes seen upon indolent ulcers little islets springing up at some distance from the margin, he came to the conclusion, very readily, that they sprang from the connective tissue corpuscles beneath, and that was the foundation of Rindfleisch's doctrine in opposition to that of Billroth. It is altogether probable that if he had known that fact he would have accounted for the appearance of these islets in that way, and would have coincided with Billroth upon the main subject, in the view that these cellular elements must spring from cellular elements of the same class as themselves,—that is to say, epithelial cells from epithelial cells. If we take then, as the established doctrine of the present day, this view of the subject, we must conclude that the proliferation must take place from the margin of the wound upon the pulp, and that the proliferation must go forward and restore this odontoblastic membrane before we can hope to have a production of secondary dentine over the exposed portion of the pulp. If we want to bring about this result we must keep this fact clearly in our mind when we cap a pulp or cover a pulp with any hope of complete restoration of the integrity of the tooth in the way that I have described; and if we keep this in our mind we must be careful not to destroy any more tissue than is already destroyed, and give these cells a chance to proliferate and repair the mischief already done Consequently, in capping the pulp I think that it is important that we should cap it in such a way as to produce no severe irritation which might lead to destructive inflammatory action.

Dr. Rehwinkel: In the paper of Dr. Brackett, the question of the methods of application of arsenious acid for the purpose of devitalizing the pulp, was brought up. This is a subject upon which I have experimented somewhat, and concerning which I have come to a definite conclusion. The

general method adopted now in the majority of cases—at least, always recommended,—is to moisten a pellet of cotton with carbolic acid; touch that to the arsenic, and apply the whole to the pulp. To this mode I take exception. I do not want any cotton whatever in the application of arsenic. It is well to understand this matter. After a series of experiments, making these applications in all the varied ways, I have found that the smaller the bulk and the stronger the agent, the better the result will be. I prefer the strongest concentrated preparation of arsenious acid. Squibbs', perhaps, is the best. I take of this as minute a quantity as will answer the purpose—simply mixed with carbolic acid, oil of cloves, or water—it don't make any difference which; because I do not rely upon sending a courier, as morphine, ahead, to intercede, modify, or to produce a local effect, in order that the action of the arsenic may be less painful. It is not the action of the arsenic which produces pain, but it is the pressure of the ball of cotton and the drug, which are placed in immediate contact with the pulp. I usually apply it with a silver, gold or steel wire, which has a small bulbous point. I am always careful to get direct access to the pulp, and to be able to see what I am doing. Then I gently bring the preparation in contact with the pulp, absorb the excess of moisture with a little bibulous paper, and then take a solution of gutta-percha in chloroform and paint this over with a very fine camel's hair pencil in order to exclude moisture and prevent all egress of the arsenic into the rest of the cavity. Finally stop up the cavity—not with cotton, but with a mixture of wax and gutta-percha, or any other kind of gum. Since I have adopted that practice I have yet to see the first case in which I could reasonably trace any bad results to the effects of arsenic.

Dr. Barker: I think we should have very good reasons for abandoning a practice that has been tested by years of experience by ourselves and our predecessors, and when I see men ready to overthrow a practice which has proved successful, upon the opinion of any one person, there should be at least good reasons advanced for the change. We have had a pulp-paste which has been used successfully, and which has been as effective and useful as we could ask for or expect. This is composed, as you are aware, of three ingredients, each one of which I contend plays an important part I am surprised that Dr. Rehwinkel can claim universal success in the application of arsenic. Let us examine the cases which present themselves almost daily in practice. They come to us in a state of inflammation; we have congestion of the capillary vessels. What is the result? I do not care whether it be the arsenic alone, or combined with carbolic acid, or

arsenic with morphia, or creasote, or anything else which is applied under such circumstances, there will, in a majority of cases, be pain; which is due to obstruction and retardation of endosmotic action from the plethora of the blood vessels.

Dr. Rehwinkel: For the sake of being concise I did not touch upon the conditions of the pulp; I simply wanted to endorse the statement in the paper with reference to the mode of application. I did not want any one to understand that I think the condition of every exposed pulp is alike. That is taken into consideration when the application is made.

Dr. Barker: I have only to state that for pulps that are not in a state of inflammation it is not necessary to apply anything but arsenic. I supposed that the gentleman took those cases which present themselves usually in our offices, which are found in that condition.

In reply to Dr. Judd, who asserted, as I understood him, that we should never, in attempting to cap pulps, make use of any escharotic for fear we should destroy the odontoblasts and possibly prevent their re-formation, I would say there is a disputed point here; the best pathologists and physiologists of to-day tell us that we have to depend upon the activity of the cellular elements for reproduction of tissue, and that it is necessary that a certain amount of irritation should be excited to induce this elaboration. We can encourage the effusion of plasma and its organization, by simply touching the exposed part with carbolic acid, because it acts as a protective and relieves the congested condition of the vessels. It destroys a portion of tissue, because its chemical action is so great, and forms a pellicle upon the surface. This is carried out exactly in the same way in other tissues. An ulcer upon the hand that refuses to cicatrize, may be encouraged to do so by the application of nitrate of silver or some other such agent which will destroy the surface and act as a protective, the same as in the case of the exposed pulp.

Dr. Atkinson: With regard to our knowledge as to whence the lime salts come which furnishes this protective covering over exposed portions, we must understand general and special circulation, to determine. I have seen amalgam fillings of two, three and more years standing, removed, which had been placed directly upon exposed pulps, and found the pulps healthy, with no intervening deposit between the amalgam and the pulp.

I have seen that repeatedly. I have seen other conditions that seem to favor the concept that these bodies called odontoblasts that surround the wall or the margin of the opening of the hard substance of the dentine into the pulp cavity, were the calcifying agents that crept over and utilized the lime salts, and closed in gradually, and at last did seal in the pulp beautifully, and protect it by perfect restoration of the dentinal wall. This has been often seen.

Now as to calcification being necessarily the product of the odontoblasts, I guess we had better enter a caveat there. Dr. Judd has beautifully given us the growth of these concepts from those two noble men that I admire very much, but we must go a little step deeper than they did into embryology before we can comprehend the whole process, and the forms of calcification. The Doctor almost said so; he said epithelial bodies of the same kind. God bless him for being able to determine that there are epithelial bodies of different kinds in the very first and simplest form of alimentary tract and glandular body. There is not an embryonal corpuscle that comes from a membrane, that is not formed from unpronounced protoplasm that you cannot see any differentiation in, any more than in water, without the use of a reagent, and these are sometimes calcified at this point, and show what are called interglobular spaces in the imperfectly developed teeth.

It is possible for calcification to take place place without having a complete formation of an odontoblast, but when they can form in sufficient quantity, and have sufficient lime salts in them, they calcify regularly; otherwise embryonal corpuscles will be formed into calcoglobine; that gives evidence of their globular form only in a state of rest; on the surface they may calcify at that stage, and then you will find no dentinal fibrils, no canals or appearance of canals, but a complete lime rock intervening between the pulp and the filling, of whatever it may consist.

REPORT OF THE COMMITTEE

ON

OPERATIVE DENTISTRY.

By GEO. H. CUSHING, Chairman.

Your committee do not propose, at this time, to go over the ground which has been so fully covered by recent reports on this department, but to endeavor to lay before you in a concise manner the present status of operative dentistry. The outlook is a somewhat peculiar one—certainly claims serious attention, and cannot fail to afford much food for thought.

It is hardly necessary to state that for several years last past there has been a very strong feeling among the better men of the profession, that the results of many operations on the teeth, particularly those performed upon the proximal sides of bicuspids and molars, were not proving as successful as had been hoped, or, perhaps, as had been the case during former years. This naturally led to inquiry into the causes of this condition of things, and various theories were advanced intended to satisfactorily explain (to the minds of the authors thereof,) this generally recognized phenomenon. Some claimed that this was simply the result of faulty operations. Were this the case, a remedy could hardly be hoped for, as these conditions are observed among men whose skill is far above the average of our best men, taken as a class; for though such criticism implies the possibility of such perfection of

operating as to render such failures impossible, yet the facts go to show that such skill rests with so very few men that practically it is unavailable for the benefit of the patients of most of the profession. Others, again, claimed that such failures were due to the use of cohesive gold, and suggested, of course, as the remedy, a return to non-cohesive or (so-called) soft gold. That this is not a satisfactory explanation, would appear from the fact that many of those observing these unfortunate results in their practice during the few years last past, had not experienced any such misfortunes in the years preceding, though using cohesive gold exclusively during both periods. Again, it was claimed that the gold was over-malleted, especially at the cervical margins. This undoubtedly explains a part of the failures, yet it can hardly cover all. Last of all comes the "Electro-Chemical" theory as a full explanation of the whole matter. Thus far the advocates of this theory have failed to furnish any proofs of its truth. Experiments out of the mouth do not establish anything as occurring within that cavity, and yet so important did it seem, to arrive at some solution to the question "why such failures were so common," and so unsatisfactory had been all previous explanations, that the profession hoped that the truth had been reached at last, and some were inclined to act upon the suggestions springing from the discussions upon this theory; but more mature thought probably convinced the majority, that there was not any satisfactory ground as yet established upon which to base a new departure in this direction.

In connection with this subject we have observed that a great deal has been said during this period in favor of tin as a better material than gold for preserving the teeth. Among the older practitioners particularly, this is true, and many seem to think there is some chemical influence exerted which tends to preserve teeth filled with tin. However that may be, the fact is quite apparent that very many have the strongest conviction of the superiority of tin over any other metal or substance of any kind, and some, in consequence of that belief, have used it in certain cases for filling over cervical margins, completing the operation with gold. Your committee are not aware of any conservative effect of any filling for carious teeth other than that secured by perfect exclusion of air and moisture from the cavity of decay, and if it is true that tin serves as a better protection than anything else, it is probably due to the fact that it can more easily be manipulated to produce air- and moisture-tight margins than any other material, though it may be impossible for us to demonstrate the fact.

Your committee have endeavored to obtain as reliable information as possible in relation to the present position of the profession on the points

suggested by the foregoing remarks. This information has come from a somewhat extended correspondence with representative men in various sections of the country, and also from quite an extended personal exchange of views, and, as a result of such information, the following conclusions are reached:

1st. That the use of tin in combination with gold, as suggested by the discussions of the theory of "electro-chemical action," advocated by Dr. S. B. Palmer, has been resorted to to a very limited extent. It, the tin, would seem to have been used by a few operators, chiefly as a covering and protection for the cervical walls of proximal cavities, the balance of the filling being completed with gold. Some of these have evidently used it because of their old time belief in its value over other materials for filling, without attempting to explain the reason of its superiority; others, again, have used it—experimentally—simply because it had been suggested; while some few, doubtless having faith in Palmer's theory, believe they see a scientific reason for its use in this manner.

2d. The use of amalgam has largely increased during the two or three years last past, and more particularly among men of high repute. From fifty-five communications upon this subject, thirty-six express the opinion that there has been an increase in its use by the better class of operators; some say a large increase, others a perceptible one. But five say there is no increase, while but one says it is on the decrease. The balance of the fifty-five either express no opinion or else a very vague one. This increased use of amalgam may be ascribed to various causes. The experiments of Bogue, Hitchcock, Cutler, and others, invited a more serious attention to the subject of amalgams than had before been given to it; and, co-incidently with these experiments and the discussions arising therefrom, a great improvement in the character of the alloys offered for sale, led those who had formerly used but little, to enlarge their use of it very considerably, and many men to make use of amalgam who had never before tried it. Many of these commenced its use experimentally, without any reasoning upon the subject, except that gold failed to accomplish what was sought, and they were ready to try amalgam because others attested to its superiority; others, again, commenced its use, or used more than formerly, because convinced by the reasoning of Dr. Palmer and others that it was more compatible with tooth structure than gold. Others, again, were actuated by some of the above reasons, and an added one of the necessity of using something which should be less expensive than gold, owing to the pressure of the hard times. These reasons

doubtless were the actuating influence with honest practitioners, and have no reference to that class who seize upon the example and teaching of prominent men as warrant for a more enlarged use of a material that they had never used either properly, intelligently or honestly; with that class this report has nothing to do.

3d. The use of non-cohesive gold has largely increased during the period under consideration, and seems to be still increasing; this especially for application to the margins of cavities, and most particularly to the cervical walls. Its use would seem to be, as a rule, in connection with cohesive or semi-cohesive gold, which is used for completing operations. As the use of non-cohesive gold increases, so does a return to hand pressure in part supplant the use of the mallet. Reference was made in the report on this subject, read before this Association at Detroit, to the tendency observed then to return to old methods. The evidence upon which this report is based goes to show that such tendency is on the increase. Also in the matter of cutting away the teeth with reference to securing permanent separations, the weight of testimony shows an increased tendency in that direction; not to the carrying out of Dr. Arthur's system, but to the establishment of a conservative system of part cutting away, and partial restoration of contour. While we find some who still adhere rigidly to the idea of restoring contour in all cases, and others, again, who insist upon the widest separation, yet the rule would seem to be the following of a conservative and eclectic plan, endeavoring to judiciously adapt the treatment to the requirements of the case.

Thus it would seem from the testimony, to be clearly the fact that operative dentistry to-day occupies more than ever before a conservative position; that is, not running to either extreme in methods as a rule, and making its practice generally eclectic. This, in one sense, clearly is an advance, and would seem to augur well for the future of the profession, but unless this eclecticism is based on sound philosophy it must be in part a delusion; and it would certainly seem to be a pertinent inquiry, upon what is this observed modification (change,) of practice based. Is this return to the use of non-cohesive gold the result of any positive evidence in its favor, or of the negative evidence against the cohesive gold, or is it in part or mainly to be attributed to the desire to render operations more speedy and easy of accomplishment? The solution of this question would seem to be a difficult one, because of the many and diverse elements necessarily entering into its consideration. If we are told that the fillings

of non-cohesive gold inserted thirty, forty. and even fifty years ago, are doing good service to-day, and that they furnish ample evidence in favor of that material, we are met on the other hand by the statement that the teeth of earlier generations were of a better character than those which we operate upon to-day, and that we of to-day undertake to preserve a class of teeth that by our predecessors were invariably consigned to the forceps; so that it cannot be said that we have any proof that is convincing. The same remarks are equally applicable to amalgam, and perhaps to tin. Again, in taking such cases of long-standing, old-fashioned fillings, as evidence on one side, we entirely ignore the lost evidence on the other side, which departed with very many of that same class of fillings: How many such proved failures, who can tell? And who can say that very many of the fillings of cohesive gold inserted to-day, will not be standing equally well with the above referred to, thirty, forty, or fifty years hence? The data upon which to base a scientific conclusion seem here altogether inadequate. The convictions of indivi luals not based upon demonstrable facts, or long tried experience, may be sufficient authority for the individual, but they can form no sound basis for any scientific mode of practice to be formulated for the profession generally. Of course it must be apparent to all that in the nature of the case a successful mode of practice in operative dentistry can only be formulated from a comparison of results of experiences of long duration. of different methods pursued by honest observers who shall have kept careful records of the results of all their operations. Have we any such basis now to work upon? Are we not, then, standing upon somewhat uncertain ground? Can we give a reason for the faith that is in us? We have in our ranks a few extremists who contend that nothing should be used for filling teeth but gold. and that of a certain kind, and after a certain method; and, on the other hand. a few may be found who urge the abolition of gold, and a resort to amalgam for filling all cavities—some very prominent gentlemen and teachers going so far as to say that the "coming dentist is to be a plastic man." Is it possible that these can advance any scientific basis for their claims? Should not, then, the thoughtful consideration of the present position of operative dentistry inspire us to a greater earnestness, and to the pursuit of more thorough and well considered methods of investigation, in order that the reproach may be removed which has been cast upon us. "that knowledge has to wait upon assumption and dogmatic opinion?"

In concluding this report your committee would venture to suggest their convictions as to that which is needed in view of what has been here said. and they cannot do so in any better manner than by quoting. as

expressing their sentiments in concise and forcible manner, the language of one of their communications upon this subject: "What we most need in 'Operative Dentistry' is a well-digested method of teaching, under the administration of honest, capable, enthusiastic teachers, who shall not be dependent upon the pupils whom they instruct, for their salaries, nor have to earn their living by general practice in their own offices. * * * One or two really good institutions endowed so as to be independent of pupil patronage" is the great need of the present time.

SUPPLEMENTAL REPORT

ON

OPERATIVE DENTISTRY.

By A. W. HARLAN, of the Committee.

The chairman of your committee on operative dentistry has already presented to you the record of another year's progress in this department of our specialty, and the duty of preparing a supplemental report has devolved upon me, in which I am expected to lay before you something that shall at least provoke discussion, if it does not instruct.

This is a subject so practical in itself, and one which engages so much of the dentist's time from day to day, that everything new in relation to it is eagerly listened to, or read, as soon as published, making it a matter of some difficulty, if not wholly impossible, to present to a body like this anything with which it is unacquainted. It will, however, need to be discussed and re-discussed until the means of preventing decay of the teeth are far more reliable in practice than any system now in vogue. This being a true statement of the case, I feel no apology necessary for presenting this paper.

It seems to me that the least observant among us cannot have been blind to the fact that the dental profession at the present time is questioning itself very closely about one thing, and that is, whether it is doing all that could be expected of it in the effort to save teeth. This fact possesses greater significance for us now than at any other time in the history of the profession, and it promises to engage the thought and tax to the fullest extent the resources of our best intellects in its successful solution. We are unable to account for the wide-spread agitation of this subject now, in any other manner than by reference not so much to the growth in numbers, as to the diffusion of knowledge, and the tendency to individual thought and experiment among the members of the profession generally, by the aid of dental journals and societies, and the work which every conscientious teacher, in and out of college, has been doing, not only in his efforts to instruct thoroughly, but at the same time impressing on the mind of the student the necessity for continued and unremitting effort as the only sure means of earning high rank in his chosen profession. This was not the condition of things fifty years ago. Then, if a new discovery were made, such was the short-sightedness of the mass of the profession that it was kept selfishly hidden in the bosom of him who made it. The practitioners of those days, it is true, had not the facilities for communication and intercourse with each other that we now enjoy, nor did they seem to feel the need of it, except in rare instances; but the time soon came when a few cultured and progressive men joined their ranks, and, by their high character and attainments, and the free interchange of individual experience, infused a spirit of study and investigation in the minds of those more selfish, until they were themselves induced to contribute to the general stock of knowledge. This was the commencement of that general spirit of inquiry which from thence until the present time has been one of the proudest boasts of the dental profession. During this period has grown up our present system of education, the formation of societies, and the establishment of dental journals, through which even the humblest in our ranks can contribute his mite to the sum total of our professional knowledge. We have enjoyed these privileges so long now that no thinking practitioner is content to accept the mere statement that a new method of operating, or style of practice, or a new material, is better than an old one, because it happens to be endorsed by Dr. A. or Prof. B., but he must have such good and sufficient evidence of its value as shall convince him that he will not be humiliated by failures in case he should adopt in his own practice their recommendations. If it be not forthcoming, he ought to be able to demonstrate for himself the truth or falsity of their assumptions.

The attentive reader of our periodical literature at home and abroad for the past three or four years, has only to take a retrospective view of the matter contained therein to be amazed at the amount of space devoted to amalgam, and it seems as though it were only the commencement of the inquiry into its peculiar merits as a substance for filling teeth, as it is now almost an impossibility to pick up a dental journal without finding one or more articles in which it receives commendation or disparagement. Now that so much has been said and written on the subject, I thought it was high time that this, the representative body of the dental profession of the United States, should engage itself in setting at rest some of the fallacious and grossly incorrect ideas that a few of their number seem to have absorbed in their advocacy of it. Not having the fear in my mind (as at least one member of this Association had at a former meeting,) that "if we ever undertake to discuss amalgam it will be a curse to the operative department, as rubber has been to the mechanical," I herewith present the following: The investigations of Professors Hitchcock, Bogue, Cutler, and others, we need not gives a synopsis of at this time, as they are so well-known as not to need it. The experiments of Dr. Bogue seem to have settled one thing pretty definitely, which is, that no constitutional ill effects are to be apprehended from the use of amalgam in filling teeth; but from his concluding paragraph I dissent. He says: "It will be seen that if almost any amalgam is used intelligently, teeth can be filled so as not only to preserve them, but to do so without danger to the general health from any element in the fillings, unless it be of copper;" of that he is not sure. My reasons for dissenting from his conclusions are drawn from experience, from observation, and from a positive conviction that there is such a want of uniformity in the alloys which are in the market, that it is useless to expect the same results to follow their use in every case. I believe that it is not saying too much to say that there is not now manufactured an amalgam which in practical use does not contract in hardening, notwithstanding the fact that some of them appear to stand the tube test for leakage, at an uncertain temperature, for two or three months consecutively. My reason for saying this is, that, without exception, the interior of a cavity which has contained an amalgam filling presents a blackened surface, and this comes from oxidation, a thing utterly impossible when an air- and moisture-proof filling has been inserted. Conceding this to be a fact, does any one claim that such a filling will preserve a tooth as well as one which has no other virtue than that of hermetically sealing the cavity? Is it reasonable to expect that a tooth will be preserved from further decay after the inception of a malady, however slight, that changes to an abnormal condition the

fluids of the mouth, if in it there be a leaky filling? I do not believe that teeth are, or have been, saved by the use of amalgams, except when used in those very hard and dense classes of teeth; and in those cases we find that the cavities are of the simplest kind; such, at least, is the result of my observations. Would it be natural to expect that a leaky filling would act as a recent writer has said on this subject, in comparing a leaky gold filling with one of amalgam? He remarks: "Leakage is one of the worst defects in a filling, and it is many times worse in connection with a gold plug than with either amalgam or tin. In the case of a leaky plug, galvanic action takes place between the plug and the dentos at every point at which they touch each other. In the case of a gold plug, the dentos is disintegrated, and by its disintegration the acid condition is kept up, stimulating to greater activity the galvanic action. In the case of amalgam and tin, the oxide of the metals penetrate the dentos and render it less positive than before, giving it harmonial relations with the tin and amalgam by being made something like them, by imbibition of the oxides; when this has taken place, electrical action ceases, because the dentos and the metals of the plug are on the same potential plane."

Is not the above an unanswerable argument in favor of amalgam? Do you not see why, under certain circumstances, the worst possible material with which to fill teeth, is gold? Further comment is unnecessary. One of the most enthusiastic writers in favor of amalgam for a permanent filling material, says: "If any of the most bitter opponents of amalgam, will produce two authenticated cases, or even one, where a good amalgam worked in a proper manner, has failed in any one point to do everything which was expected of it by its most 'ardent partisans,' I will never say another word in its favor." But his wisdom is greater than that of the whole profession combined, for he concludes by saying, "I know too well from experience, that such a case cannot be found." I submit the above to you, and ask if it is not disheartening to those of us who still have sufficient faith left in the preservative qualities of gold, tin, and some other ephemeral stoppings, to continue using them in the face of such an assertion. Here is another statement which has *not* been shown to be true; the writer says. "Gold has been shown, by actual experiments, to be the most electro-negative substance which is used in teeth. * * * * And it has been shown that tooth substance (dentos,) is more electro-positive than any of the filling materials which we use." Further: "It must be instantly admitted that a plugged tooth is in a dangerous condition, aside from the fact that a portion of the tooth substance has been lost and the

pulp possibly interfered with" These extracts are presented as veritable curiosities in a dry and matter-of-fact literature such as ours. I do not instantly admit that a plugged tooth is in a dangerous condition because it happens to be filled with gold. The experiences of the past two or three generations of dentists must indeed have presented a sorry record for those of the present who still continue in the face of such a long list of failures as the above would indicate, to consign a tooth to certain destruction by filling it with gold; nor do I believe that it is admitted by any one who says to himself that his object in filling a tooth is, first, to prevent the recurrence of decay, and second, to fill the tooth so thoroughly as to exclude air and moisture. Can anything else be accomplished by the operation of filling a tooth? What miraculous influence is it that is so potent in saving a tooth by the use of amalgams, when they do not shrink after their insertion? Is the exclusion of air and water from a cavity anything more than a mechanical operation? If it is nothing more than this, how is it possible for dental alloys to exert a chemically preservative influence on dentine if they do not leak around the margins after insertion? Must we conclude that there is such an affinity for amalgam by the mixed fluids of the mouth that it alone suffers loss of substance when there is an ailment sufficient to furnish an acid saliva? Does experience show that there is any loss of an amalgam filling when in practical use, except by attrition? I think not. I do not comprehend such far-fetched reasoning when it is based on experiments conducted wholly out of the mouth.

The writer of the above extracts has a process of his own by which he has been enabled to determine the approximate amount of loss which *living dentine* sustains when compared with the different filling materials in use. I was the first person to question the correctness of his conclusions, in a note despatched to him soon after listening to his paper on "Oral Electricity," in May, 1876. The answer received contained a promise of an explanation soon. Since that time has been published another article on the same subject, addressed "To students and young practitioners." But the promised method of determining that vital point was not given. I am in ignorance of it to this day; however I make the following extracts from that article. He says: "Let us make an electro-positive scale of the materials with which we plug teeth, including dentos itself. The most positive substance will be mentioned *first*, and then they shall follow according to the strength of their position. Dentos (dentine or enamel), Smith's Ox. Chlo. Zinc, Hill's Gutta-Percha, Tin, Amalgam, Gold. Either of these substances if united to one anywhere below it on the above scale, will dissolve more rapidly in an acidulous fluid

than if alone in the fluid. A current of electricity is evolved, passing from the more positive to the less positive substance, and at the expense of the more positive. Between *dentos* and *ox. chlo. zinc* the current would be weaker than between *dentos* and *tin*. Between *dentos* and *gold* there would be a stronger current than between any other two substances; consequently the dentos would be broken down or dissolved more rapidly than it would be if united to tin, amalgam, or the other materials in the list. * * * * Dentos is a poorer conductor than gold or tin, yet whenever either of these metals are united to tooth substance, then the latter is readily destroyed if there is an acidulous fluid in which both are immersed." "*Living* dentine," says he, "has much greater conductivity than dead dentine." Until the author of the above can substantiate, in some manner, the correctness of his conclusion, (which is not very apparent,) that living dentine does stand in the relation to the different filling materials in which he has placed it, I cannot accept, for myself, its finality. It is true that we may not be able to prove the contrary, but one thing we are sure of, and that is, of the known impossibility of immersing a piece of dead dentine or dentos in an acid liquid and determining from the amount of loss by dissolution of its substance the percentage which it would have lost had it been possessed of vitality. Our author's further conclusions are, that the nearer a plug is to dentos on such a scale as presented, the better is that material for saving purposes so far as galvanic action is concerned. To use his own words, "this would make ox. chlo. zinc the best filling in some respects. * * * Hill's stopping comes next on the scale. * * * Tin follows the last. * * * It is more easily made water-tight than gold. * * * Amalgam comes next. It is easily made water-tight" (in a glass tube?) "if the alloy is properly prepared, more easily than with gold or tin, and it bears mastication as well as gold. Gold" he says, "if properly manipulated can be made water-tight, and wears well; it produces stronger galvanic action united with the tooth than any other filling material." Are we prepared to accept these conclusions, so antagonistic to all of our previous experiences, based as they are on the supposition that the one vital material, dentine, stands in the relation to filling substances in which it is placed? What a mighty revolution in prospect for those of us who have striven to educate our hands to do the bidding of the brain in creating those finished and certain destroyers of the teeth into which they have been wrought!!!

One eminent gentleman, an enthusiast on the subject of plastic fillings, says, "I know that some few men have the peculiar art of manipulating

gold more successfuily than the vast majority, just as some few artists have extraordinary and unattainable skill with paint, with the chisel, and with musical instruments;" while another equally eminent, to my mind, though he does hit hard, says, that the operation of filling a tooth with gold is one of the simplest and easiest, and he would almost agree to take from the street a youth without knowledge of such an operation, and teach him to fill the simpler cavities very acceptably in six months. I cannot agree with either of the gentlemen quoted; the first requiring rather more skill than is absolutely necessary in successful practice, and the second not requiring quite enough. At last we seem to have found the vulnerable point: it takes too much time, and requires more skill to fill a tooth with gold than it does with amalgam. There's the rub. And then, after the tooth is filled with gold it fails to exert that chemically preservative influence which is so necessary to the dentos; and that is another reason why amalgam is better in their hands than is gold. In the hands of those who feel incapable of inserting a moisture-proof filling of gold, any of the baser metals or stoppings are infinitely to be preferred to extraction of a tooth; but from the experience of the many, from that of the most successful operators, amalgams have proven themselves in actual use, without regard to tube tests, so unreliable that we are unable to point out one single practitioner in this broad land of ours who has made for himself name and fortune, or either, or one who has succeeded in preserving an equal number of teeth by its use, side by side with one who has tried conscientiously to do likewise with other substances. I am not disposed to underrate the value of the recent investigations on the subject of amalgam, but I do protest against any one claiming for it superior virtues which the whole profession have been unable to discover in its more or less constant use for a half century, no matter from what quarter or from whom it proceeds. So far, what good has been accomplished by its re-discussion? One who looks the question squarely in the face finds that where there used to be one kind of amalgam there are now half a dozen, all claiming to be what a large majority of them are not, i. e., perfectly harmless, and the very best of filling materials for "badly decayed molars;" each one yielding a different result when analyzed, and no two results of any one of them on second analyzation showing anything like uniformity, or approximating the first. To these defects it may be added that the directions for use equal in number the varieties manufactured; and add to this an increased sale, not only in one section of the country, but all over it.

When we have Dental Journals saying month after month that gold under certain conditions is the worst possible material with which to fill

teeth, and proclaiming this as the truth beyond question, is it not time to stop and ask if this be progress? Would it be unnatural to suppose that some of the younger men, and possibly older ones too, might conclude that perhaps amalgam was a cure-all, and go to using it vigorously, and probably at the same time be doing an injustice to their patients? We only dare hint at such a probability. The dental profession owes to itself, and the public whom it endeavors to serve, to see to it that this question of filling teeth, and with what substance (if any,) it is most surely to be accomplished, shall be discussed at this time in a manner which its importance deserves. We can no longer claim to be a liberal and progressive profession if we do not take upon ourselves the duty of solving this question. We know that the use of gold, i. e., the intelligent use of it, is sure to produce certain results; the same may be said of tin, but of amalgam it is the height of folly to expect to obtain an uniform result in the use of it by the wisest among us. It seems as though some such plastic compound were a necessity in certain communities, and for good reasons that are apparent to all of us, and the only way that suggests itself to me in which we are to derive any permanent benefit from its consideration, would be the appointment of a committee to investigate and experiment until they arrive at a definite result, and report the formula of an alloy that will, with reasonable skill, care and judgment, give a non-shrinkable and reliable substance for filling teeth, and one that shall not be in any way injurious to the general health. Then, and not till then, will the great public, through and from whom we receive recompense, be benefitted by our labors in their behalf.

DISCUSSIONS.

Dr. Rawls: I believe that our failures occur not only on account of imperfect materials used, nor on account of a want of skill, but because of the existence of animal fluids in the dentine, which are constantly coming into contact with the filling, causing oxidation when the material used is of a nature to be oxidized, and in other instances bringing about disintegration of the dentine beneath the filling; the latter is especially noticeable in the teeth of young persons where the dentinal tubuli are large. If you desire to test this matter, adjust the rubber dam on a tooth, cleanse and dry well the cavity until it presents a white, powdery appearance, after which cover the cavity over with a bit of rubber, or other material, to prevent moisture in the atmosphere from condensing on the dentinal surface; leave it there for a few seconds, and upon looking into the cavity you will find that the dry, white appearance has disappeared, and in its stead you will observe the darker appearance charateristic of dentine when filled with its natural fluids. In cases where the dentinal canals are large, admitting of an abundant flow of the animal fluids, plastic fillings can often be used with more success than other kinds.

Dr. Howe: During this discussion I have seen very much light thrown upon these subjects by the relation of facts, and I have seen them very much darkened by theory merely. More than a year ago a gentleman came into my office suffering from a tooth which six years previously I had filled with amalgam. He had been traveling west, and found himself with a very sore tongue, and he consulted a physician, who prescribed for him, treated him for a week or more, and, affording no relief, he said, "I will make a thorough examination of this case;" then took the speculum, made what he called an examination, and, so soon as his eye glanced upon this tooth, he laid down his speculum and said that it was a very clear case of

mercurial sore tongue: the only possible relief for that would be the extraction of the tooth. The tooth having done good service for a number of years, the gentleman thought that he would not have it extracted, but wait until he got home and consult me. I looked at the tooth and the tongue, and, with a corundum wheel I smoothed the edge of tooth, which had become by grinding wear as sharp as a knife on the lingual edge, and had continuously cut the tongue. I said, if you have any more "mercurial sore tongue," come again. He has not been in since. I saw him upon the street, and his tongue was well.

Dr. M. H. Webb read the following paper:

While I coincide with Dr. A. W. Harlan in nearly all he has stated in reference to amalgam, yet I desire to refer particularly to the report upon "Operative Dentistry" which he read at the meeting of this Association last year. In an otherwise good report he asserted that "the perfect contouring of teeth is the most absurd of all hobbies." No better evidence could be desired to indicate that he who makes such an assertion does not fully understand the principle of, and is unable to properly perform, those operations known as restoration of the contour line of an organ which has been wholly or partially broken down, or fractured, by caries. Since "the *perfect* contouring of teeth is the most absurd of all hobbies," it may be inferred that "*imperfect*" contouring is what Dr. Harlan terms "wise conservatism." Really perfect restoration of contour "demands" far greater "perfection of good judgment" than that which was referred to as "wise conservatism." Whatever is worth doing at all is worth doing as perfectly as possible; and it is entirely wrong to accuse those of having "hobbies" who always endeavor to do this. No one should ever enter upon a calling, or pursue a work, unless he be enthusiastic in, unless he love, that work, for "*By their works ye shall know them.*"

In reference to this matter and to various assertions, I would further say that no one's theories should be accepted, nor teachings followed, unless he who announces them has *demonstrated*, beyond a question of doubt, that he is really capable of properly doing that which he professes to do. It is also important to know whether all those who propound, advocate, or accept the "theory" of recurrence of caries around or about fillings, because of chemical action and evolution of electric currents, are truly first-class operators. If, for instance, Thos. Fletcher, of England, was really capable of performing even creditable operations, then his opinions upon such matters

would be entitled to some consideration; but because he is not thus capable, his tests in reference to the "leakage" around gold fillings are worthless. Even if he was fully capable of performing an operation well, he, nor no one else, can insert gold in a glass tube without having a movement of a portion or the whole of the mass of such gold, because there is no good foundation to build upon, no starting point. A something might be put in one end of a tube, and be so arranged that a foundation may be made, but unless this is done, no form of gold can be anything like perfectly packed in such a place, whether the gold be cohesive or non-cohesive. Even the insertion and packing of pellets and cylinders in cavities of decay, without some movement which would lead to that which is called "leakage," is quite as uncertain.

Dr. S. B. Palmer, the most reliable investigator in the department of chemistry which relates to the action of acids upon dental tissue and the evolution of currents between metals and calcium, stated at the last meeting of this Association that he agreed with your speaker that "failures, in a a great measure, are due to imperfect operations, * * * * to imperfect contact of the gold against the dentine;" and, that "where there is no moisture, there is no action." He stated, however, that "if a gold filling fails in the hands of a practitioner of average respectability, in certain cavities and certain teeth, it reduces that tooth to the second class of teeth, viz.: those which must be saved by some other agency than gold." I desire to say that a practitioner may not only be of "*average*," but of the *highest* "respectability," and yet not be a first-class operator. A tooth is not necesarily "*reduced* to the second class of teeth" because of the failure of a gold filling, even if he who performed the operation was really a first-class operator.

While Dr. Palmer fully coincides with me in stating that "where there is no moisture, there is no action," yet he has also stated that we "cannot rely on the mechanical perfection of a filling." It has been truly said that "in the hands of a first-class operator ninety-five per cent. of teeth may be preserved with gold; * * * but with an ordinary operator there may not be more than fifty per cent. thus saved." Does not this prove that the success of an operation depends almost entirely upon the capability of the operator?

Pellets and cylinders may do for the stopping up of cavities which are treated as simple holes, and where dental tissue is cut away so as to conform to such filling, but it is not best to have the gold, in such form, cohesive.

for the reason that the difficulty of properly performing operations is thereby only increased; the gold, in such forms, cannot be so easily impacted as when it is not in a cohesive condition. For all *first-class* operations, however, the gold should be cohesive, and be so prepared, introduced, and impacted, that it shall be firmly anchored from the first piece inserted to the last impacted, and so that the filling shall be uniform in density, the gold well packed against the dentine and enamel, and over attenuated edges so as to protect them, and the whole of that portion of the organ which may have been destroyed, properly built out, and finely formed and finished, so that it it may be in conformity with the natural type which was the design of the Master.

Dr. Corydon Palmer: With the permission of the body I wish to be allowed to correct an error in the Transactions of last year. I am represented there to have said, that when we had filled a tooth, we had done nothing more than any ordinary jewelers could have done. It makes me seem to say that which I did not intend to say. What I did intend to say was, that one of our would-be teachers and authors said, or rather asked us the question, "When you have filled a tooth, what have you done? you have done nothing more than any jeweler could have done, and he could have done it better even than you have." I say it is derogatory to our profession, and I do not wish to be considered as having said it; but as it stands on the record it makes me seem to say what I do not believe to be true.

What I would speak to you of this morning is in reference to practice, and I am sorry to see that anything in reference to practice is becoming very unpopular with this body. I have no fine theories, and never attempt to offer them or to discuss them. To me something real, something practical and fine, has been my forte. It has been what I have devoted my life to; and if I offer you anything, I want to offer you something that is fine and practical. The particular point that I wish to bring forward is in reference to restoration of the teeth, or what we have termed contour operations; but more particularly the elongation of teeth when they become shortened by wearing away until something is demanded to stop the wearing and prevent the danger of exposure of the pulps. Some of you may remember that some two years ago, I think it was in June, 1875, there was published in the *Cosmos* some diagrams and views of mine which I would be glad if each one of you would try to find and read, if you have not seen it. Everything is finely represented by minute diagrams, and my views are given more fully than I can give them to you here.

[Dr. Palmer here entered into an illustration by blackboard diagrams of his methods, and exhibited a cast representing a set of natural teeth upon which he had operated.]

Dr. Hall: I know that many present have taken some interest in a report made upon the replantation of teeth, for two years past, by Dr. Morrison; and, as many of the cases were mine, and nearly all of them came under my observation, you may wish to know the result. About one hundred cases have been reported in all, and in that number we have had about a half a dozen failures, attributable to perhaps three causes. One is the disturbance of the socket in order to accommodate the replacement of the tooth, where, in order to correct an irregularity, or to force a tooth into the socket beyond the point that it occupied before extraction, a portion of the socket was injured. In the only case that we have had of that nature, there ensued a morbid action that completely destroyed the root, eating out little finely polished cavities, beginning at the apex of the root. Another cause is the destruction of the process in extraction, or in the replacement of the tooth; in the latter case, forcing the bone down underneath, and thus establishing a disorder that could not be cured; and the other cause is the lack of proper support for the tooth after returning it to the socket. The other cases are almost entirely successful, and in fine condition. Two cases of transplantation have been eminently successful; one in which the third molar was transplanted from the mouth of one sister to the alveolus of a second molar in the mouth of another; and the other the exchange of lateral incisors.

The President: How long since the latter operation was performed?

Dr. Hall: About one year. I think the other case was reported at the last meeting. The success attained by this operation, and the good that may be derived therefrom, are truly wonderful. I will refer to the other cases of replantation. One, a lateral incisor, came under my notice when the patient was thirteen years of age. The tooth was black, and I supposed it an ordinary case of a dead tooth. I did not then inquire closely into the history of the case, but upon opening into the root of the tooth and pursuing the usual treatment, I never was able to arrest the hemorrhage; every time I removed the dressing from the root, blood followed, and baffled all effort at treatment in the mouth. I extracted the tooth, and found the root about three-quarters formed. The labial portion of the alveolar process seemed to be entirely destroyed. On inquiry I found that the child had received a

blow from the handle of a windlass at the age of ten, and from that moment development seemed to be arrested. I filled the root with Hill's Stopping, and the opening that I had drilled into the pulp cavity, and replaced the tooth accurately in position, and then allowed the child to articulate the lower ones to that. I saw the patient last fall, and the tooth was doing well. That was four or five months after the operation was performed.

Dr. Waters: Some nine years ago I commenced replanting teeth, and from that time to this, I have at times performed two or three such operations a month. My second operation was in my own mouth, taking out a lateral incisor at eight o'clock in the evening and replacing it the next day at eleven. That tooth did good service for five years; the loss of it was purely accidental: it was broken diagonally across the root under the gum, showing no effect of the fracture for some days, when inflamation came on and gradually that portion of the tooth connected with the crown, loosened its hold upon the socket and dropped off. My next case was the transplanting in my own mouth of a bicuspid. On the 12th of January I extracted from the mouth of one of my own children a bicuspid tooth to allow the canine to come into place. This bicuspid had a slight defect in the crown. I opened through that into the pulp canal and filled the root with gold; placed the bicuspid in a bottle containing water with a small percentage of carbolic acid, thinking I would celebrate my fiftieth birthday by using it. I had a bicuspid which had been broken off, and on my fiftieth birthday I got my friend, A. T. Bigelow, to extract the root. I then went to my office and took this bicuspid from my bottle and placed it up in the socket, and found it was so long on the inner cusp that I could not shut my mouth. I took it out and ground off the inner cusp, and I kept grinding until it fitted, and then I ligated it in place, and it has been a serviceable tooth ever since.

A Member: How long had it been in the bottle?

Dr. Waters: From the 12th of January to the 23d of March.

Dr. Taft: There should be two objects aimed at and attained, if possible, in our profession; the one is the giving and receiving of new ideas, new thoughts, new modes of practice and so on; and the other, and I presume about as important, is the putting into practice that knowledge which we have. There is perhaps as much necessity for this now as for an increase of knowledge, and especially to such men of the profession as are

assembled here to-day. It is desirable to acquire more knowledge—to learn new facts—but it is also of very great importance that we should be stimulated to apply the knowledge we already possess—to live in our daily practice up to the highest attainment which we have made, and to make use of all the auxilliaries at our command to this end. There seems to be a very considerable change indicated in one of the reports, at least from that report there seems to be a turning back to methods and modes of practice of former times, and it is frequently said in our associations that it is time we should retrace our steps and see how far we have gone, and examine the ground over which we have passed.

If we mean by this to go back to the practices of years ago, let us enquire why it should be so? Is the present mode of practice proving deficient and defective? Are we failing to accomplish as much as was accomplished in our practice years ago? If so, it is a sad commentary upon the progress of the times. It is a sad commentary upon the manner in which operations are performed. Knowledge has been increased very greatly during the last quarter of a century, and in general principles, in modes of practice, in therapeutic agents, in modes of treatment, we are almost daily or weekly learning something new, and much of this is better than anything we had before. Instruments and materials used for filling teeth, are constantly being improved.

Under these accumulative circumstances are we going back, failing to accomplish the work as well as a few years ago? If this is so, I say it is a sad commentary upon something. Is it upon our integrity? Then let us be stimulated to use all these things in the very best possible manner. Many criticisms have been made recently upon gold, as a material for filling teeth. Other materials are suggested, amalgam, for instance. There has been an average of one new amalgam a year produced for the last twenty-five years, and each one of these has been perfect; that is it has been declared to be efficient for saving the teeth, would not contract in solidifying, would not oxydize, would save the tooth better than gold. This has been claimed for every new amalgam which has been produced for the last twenty-five years, and each and every one of them at the present time, has signally failed in almost all of these respects. It is true that some amalgams may be made that may be worn in the mouth for many years. Gentlemen say they have seen amalgam fillings worn year after year. That is very true; no one denies it, no one denies but what amalgam fillings will often-times remain in the mouth for years, and seem to preserve the teeth, but is the integrity

of the metal as good as that of gold? That is the question. Where there is one success with this material, I have no doubt there will be many failures; at least that is the result of my experience from the observations I have made. I have no experience so far as manipulating and putting amalgam in the teeth goes. It has been said to me, you ought not to have any opinion about amalgam if you have never used it. I do not think that in order to know anything about this material one must have gone into it to the depths of its degradation; it is not necessary, in order to know something about sin, that we become the vilest sinners. We can see how other people do, and we can come to the conclusion that it is not the best thing. The use of this material is increasing daily, and it is a very sad picture to me to see our profession going back, taking up an inferior material and claiming for it, for the purpose of filling teeth, merits which experience will not sustain.

Dr. Thomas: I would like to call further attention to the matter of replanting teeth, having had some little experience in that direction for the past eighteen months. I have treated between fifty and sixty cases within that time without the loss of a tooth, so far as I am aware; I have replanted all the different classes of teeth, sometimes finding it necessary to cut away a part, or even the whole of the root of a molar in order to be able to return it to its proper place. I will only detain you long enough to recount two cases wherein I regarded the success of the operation quite as doubtful as any I had undertaken at the time. One was the case of a left superior lateral incisor in the mouth of a gentleman about 35 years of age. None of the incisors had ever suffered from decay. The tooth in question had presented an abscess at its roots some five years previous, without any known cause. The abscess had been treated by three different parties without a cure, when he presented himself to me. I found the tooth much discolored and quite loose; it also occupied an angle of several degrees from its normal position, protruding very much; the labial portion of the alveolus was entirely gone, having been completely absorbed some time before. The tooth had been opened into, pulp removed and canal filled—the fistulous opening at the apex had been enlarged from time to time, trephining having been resorted to on various occasions.

After a very careful diagnosis and considering the matter for two or three days, I decided to remove the tooth, and replant it if possible, but with very little hope of success, as the parts about it had become so diseased. Upon removal I found that at some previous time—probably

during one of the trephining operations—the tooth had been cut nearly half off about one quarter of the way from the apex down to the gum margain. I found the filling in the canal good to this point. I cut off the portion above the notch, replaced it—after having cleared away all the diseased portions of alveolus—brought it back to its normal position, and attached it to the adjoining teeth with silk ligatures. About three weeks ago I examined this case and found the tooth nearly as firm as its mate, occupying its normal position and doing excellent service.

The other case I wish to mention is one where a gentleman sent his coachman in to obtain relief. The superior central incisor was abscessed, face very much swollen, and apparently just ready to rupture. I extracted the tooth, and the discharge of pus that followed the operation was simply amazing. Being very enthusiastic at that time on the subject of replanting, I suggested to him—as an experiment merely—to replace it, but his mouth was in such a filthy condition—probably never having seen a tooth brush—that I had not the stomach or the courage to do my duty. I cleaned the cavities and canal as best I could, filled them up with amalgam and replaced the tooth. There was so much swelling in and about the parts that it refused to go properly to place, but dropped down about one-quarter of the length of the crown, but I did not touch it further, not even to put a ligature upon it, which ought to have been done. It became so firm that in three or four months he came back and said the only trouble he experienced was from its too great length, which I corrected by cutting off to correspond with the others. It suggested itself to my mind at that time that in many cases where we have abrasion and the teeth are broken down (either by accident or otherwise,) until there is an exposure of the pulp, the teeth might be extracted and replanted in such a manner that they would present a natural appearance as to length. This could be accomplished by not replacing them as deeply in the sockets as they were originally, and then holding them in position until they become firmly secured. I offer this as a suggestion only; I do not advise it until I have experimented in that direction, which I shall do at my earliest opportunity; but to my mind it is perfectly feasible.

Dr. McDonald: I do not wish to be understood as making excuses for amalgam; at the same time I should be sorry to have it understood as the sense of this body, that amalgam is never to be used. Our friend Dr. Taft informs us that he has no knowledge of amalgam from having manipulated it himself.

DR. TAFT: In the teeth.

DR. MCDONALD: To place myself right, in the first place, I will say that in my practice, perhaps I put in one amalgam filling where I put in one hundred of gold; but at the same time I should feel sorry for a patient who should fall into the hands of an operator who never uses amalgam. I find in the practice and in the predisposition of the dental profession, a tendency to two extremes in this matter. We have extremists on both sides, and I think that both are doing harm. I claim that if a practitioner of dentistry fills all teeth with gold, and uses nothing else, he is liable to do quite as much injury, perhaps, as another who would fill all teeth with amalgam. No one would advocate the latter. I would not, nor indeed filling any teeth with amalgam that can be saved with gold; but my experience has taught me that there is a class of teeth that cannot be saved with gold. There are certain classes of cavities, in my practice, which I do not fill with gold, especially in the wisdom teeth, and some other molars, where I find the structure so poor that it will not compensate the patient for the torture, or if he lacks the financial ability to pay for a large operation in gold; yet I claim that gold is the best material for filling the best teeth.

DR. MORRISON: [The following extract is taken from a letter from Dr. Morrison, which was read by the Secretary.]

"Of sixty-seven cases of replanted and transplanted teeth reported to this Association, taken as they come, ages ranging from eight to sixty years, with constitutional and physical conditions varying nearly as much, I have to report the loss of five replanted teeth. Case No. 3.—Because the peridental membrane had been enveloped by a thin scale of tartar years before it was operated upon. The tooth was retained in the jaw, however, over one year. No. 10.—Had its root nearly absorbed off, chiefly on the buccal side. It was retained in the jaw about two years, and stood very firmly until a few weeks before it was extracted. No. 24.—Root much enlarged by exostosis; retained but a few weeks. No. 26.—Outer plate of the process fractured in extraction. The tooth gained some stability, and was used one year. No. 56.—Had some cavities absorbed in the roots near the apex, and also near the cervical margin.

"New cases replanted since last report, eighteen; transplantation, one, viz.: the left superior lateral incisor; a descriptive history of which I had intended to present this year."

Dr. Barker: I am glad that the letter from Dr. Morrison has been read for our instruction, for it seems to me that we are rushing somewhat blindly into this practice of transplanting and replanting teeth, and that possibly some disastrous results, which we do not anticipate, may follow. I would say in regard to the method of lengthening teeth suggested by Dr. Thomas, that this can be accomplished much better by means of ligatures which will gradually draw them from the sockets to any desirable degree, and osseous depositions will form around the roots, and retain them in place. It was unnecessary to cut off the protruding tooth in the case he referred to, because it could have been readily forced back to its former place with properly adjusted ligatures.

Success in replanting teeth cannot be expected unless provision is made for drainage. An opening should be secured for the escape of the fluids in the alveolar socket, whether the tooth be in the upper or lower jaw. I have had long experience in replanting teeth, some of which has led me to regard the practice with distrust. I have no doubt, however, that in a large majority of cases this operation may be successfully performed; but much depends upon careful manipulation, and the extent of the injury sustained by the surrounding parts in the extraction of the tooth.

Dr. Atkinson: Whenever we can get perfect adaptation of any indestructible material to the walls of a cavity that has been cleansed from all the disintegrating and soured substances that are in process of retrograde metomorphosis, and so seal it up with anything that is indestructible by the fluids of the mouth, we have to all intents and purposes saved the tooth. Then we have the question as to what best accomplishes this; whether soft plaster, and such trash, can be put in so as to exclude moisture more successfully than any substance requiring the delicate perception, and manipulation, and dexterity that gold requires. And when gold is put to its proper place does it not pre-eminently fulfil the conditions that I have spoken of? Is it destructible in the mouth? Is it not absolutely indestructible in the mouth by any currents that we know of. that can act in the mouth without destroying its entire tissues? I think it is want of mental perception and clearness of comprehension that makes any one advocate a fallacy. Let us see where the fallacy is, anod see whether we are wiser than the original architect of the human tooth. What then is the proper method of restoring a decayed tooth, but to clean out all the disintegrating material, and put something there that shall be anti-zymic in its nature—anti-fermentive—a friend at court, and then fill so

as to restore the contour of the tooth, that its ghost may have the same sized house of the new material, to live in, that it had in the material that it built itself; and then we have a restoration; and if that is not contour, I do not know what contour means. I do not mean contour of the tooth if it were worn down, because it would never do to restore such a tooth to its normal shape, and let it bang away against its opposing one, when it has been worn down to a certain level.

Dr. Allport: The impracticability of treating aveolar abscess of long standing and restoring the parts to a healthy condition, having been somewhat questioned here, with the permission of our President, I will state that at the time of the meeting of the American Dental Association at Detroit, he showed me a case of some twenty-two or twenty three years standing that he had successfully treated. The case was a central incisor, over which an abscess had not only formed and discharged through the gum, but there had also been a profuse discharge into the nasal cavity. The case had been treated with carbolic acid and when I saw it, the abscess had healed, and the parts were in a healthy condition, and I am assured that they remain so at the present time.

Of course carbolic acid cannot always be relied upon in such cases, but when it will answer, it is as well not to resort to more powerful agents. Sometimes sulphuric acid or aromatic sulphuric acid will meet better the requirements of the case, while in other cases, mechanical means are required. In my judgment, it makes very little difference whether the abscess be of recent or long standing, provided the treatment is such as to remove all diseased tissues, and the parts are left in a condition to take on healthy action. This done, nature will soon restore the lost parts and the cure will be complete. It will make little difference what is done so long as necrosed bone or rough and sharp surfaces are left, for so long as either of these conditions remain, a healthy condition of the parts cannot exist.

One word in regard to the replanting of teeth. That teeth can be successfully replanted and retained in the mouth for a few years, I have no doubt, but that they will as a rule remain there in a *healthy* condition for a great number of years, I do not believe. The question in my mind is not whether they can be replanted and kept in the mouth for a few years, but will they remain in a healthy condition for a considerable length of time—more than a few years. The replanting of the teeth is by no means a new idea, either in this country or in Europe. My first experience in

this practice was some twenty years ago, an account of which was at that time reported by one of my assistants for the Dental Register, under the title of "Just to please his Mother." It was the case of a boy some seven or eight years of age, who had one of his central incisors torn out while hanging to a swing by his teeth. When the boy's father brought him to to me, he made the remark that he did not suppose it would do any good to put the tooth back in its place, but he wished I would do it "just to please his mother." The tooth had been out say an hour and a half. I syringed out the socket and washed off the tooth and adjusted it in its place, securing it to the adjoining tooth by a silver wire. In a few days it had united with the socket, but after a few months, an abscess had formed over it. I drilled into the pulp cavity from the lingual service, cleansed it out, and filled root and crown with gold. The abscess soon healed. The color of the tooth remained remarkably good, but after a few years the root at its apex became entirely denuded and protruded through the gum, irritating the lip so much that I cut it off and polished it down to prevent the irritation. In my experience, I have met with several cases of replanted teeth, and I have seldom seen one where the parts around retained a healthy condition after a few years, and I do not believe that a general practice in replanting teeth should be adopted.

Dr. John Allen: I have replanted teeth when they were very sensitive. During the whole operation the patients declared that they had not suffered nearly as much as if the tooth had been excavated while in the mouth. These teeth have done well for many years, more than ten I know. I dislike the plan of narrating individual cases, but I will refer to one simply. A boy had his teeth knocked out from a kick by a horse; the four front teeth remained in the sand some two hours. Those teeth were washed in warm water, cleansed and returned to their sockets, fastened with ligatures, and to my knowledge for twelve years after, were good substantial teeth, and retained their natural color.

Dr. Thomas: Were the pulps taken out?

Dr. Allen: No sir; that is another point that I wish to speak of. I contend that it is an important point to retain the pulp in the tooth; that the vessels of the pulp may reunite at the apex of the root. I believe they do this, from the fact that we see the color retained in the teeth perfectly, and I believe there is a good healthy circulation going on through such a a pulp, after the tooth has been replanted in that way.

REPORT

ON

DENTAL EDUCATION.

By THOMAS FILLEBROWN, of the Committee.

I shall confine my report to the consideration of the following points:

Dentistry a specialty in medicine;

A thorough medical education essential to the most successful practice of it;

The expediency of existing medical schools including dentistry in their courses of instruction;

An account of some action that has been taken by several societies in regard to dental education, and some suggestions as to the action this Association should take in regard to the matter.

That dentistry is a specialty in medicine needs no argument here, for it is written in the preamble of our constitution, and embodied in its articles, and endorsed by almost every individual member who has spoken before this body, or written an article for its edification.

That a medical education is essential to the practice of dentistry, has not, I think, been so fully endorsed by this Association, although it seems but a corollary of the former proposition. It is with reluctance that I reproduce the arguments to sustain that proposition. They have been presented many times, and ably, and are well understood, and I wish I might add, their force fully appreciated. But so long as the proposition is not actively, as well as passively, endorsed, these arguments will be in order. As I understand the use and significance of a medical education, it is not that a graduate leaves his *Alma Mater* as well fitted to practice any branch of his profession as he ever will be, but rather that he has just become well fitted to begin to perfect himself in the profession he has chosen, or whatever branch of it he may prove himself best fitted for. I presume no dentist in this Association, nor out of it, nor any individual of the public whom we serve, will for a moment question the propriety and need of a very thorough medical education for the specialist practicing ophthalmic surgery; nor does any one doubt the healthfulness of the public opinion that compels every one who would be a respectable practitioner in diseases of the eye to first obtain an education guaranteed by his degree. Although much good might be done by a conscientious ophthalmic surgeon who knew nothing else, yet in this case every one present realizes the evil that would follow a state of public opinion which would tolerate uneducated practitioners in this department of medicine. Surgery of the eye and of the teeth are as intimately associated with each other and with the welfare of the whole system, as the eye and maxillæ are close in anatomical relations in the human face. Inflammation of the dental branch of the fifth pair of nerves differs in no respect from that of the ophthalmic branch. Ulceration of the mucous membrane of the mouth is in no wise different from ulceration of the mucous membrane of the eye. Congestion of the periosteum of a tooth is the same as congestion of the periosteum of the humerus. Necrosis of a jaw and of the supra-orbital plate differ in no respect; and the treatment in each of the above cases should be governed by the same principles, and similar remedies applied, and the same education is necessary for their intelligent application.

It is, I believe, conceded by every one that, other things being equal, the person who has the medical education is best fitted for the practice of dentistry, as well as other branches of medicine. I was deeply impressed with the force of this at a meeting of one of our leading dental societies. During the discussion of a paper presented by one of the best educated dentists in the country, the question arose as to his correctness in regard to some deleterious local influences which he mentioned. The reply was short

and decisive: "He is an educated physician—has practiced medicine, *ergo*, is *particularly* well qualified to judge;" and no more was said on that point. This is indicative of the opinion of every dentist and of every individual in the land.

When a medical graduate attends a succeeding course of lectures at a dental school, the respect that is paid by both fellow-students and teachers to his acknowledged superior acquirements, is very noticeable, and, also, the certainty with which his passing his examination is assured, or, it might almost be said, passing without examination. This feeling is entirely reasonable, for the greater includes the less, and the medical graduate needs only to be perfected in the handiwork and technicalities of his specialty to be thoroughly qualified for the commencement of its practice.

Another fact of importance and worthy of consideration is, that the minds that have been active, influential and efficient in elevating the practice of dentistry to its present perfection, and in improving and enlarging the mental culture of our members, and that have done most towards forming an exalted and healthy public opinion in regard to dentistry, are, as a rule (with some noble and notable exceptions), the minds of medically educated men. The standard literature on dentistry is the product of the same class of minds. I find no fewer than sixty-eight volumes and monographs mentioned by different authorities as having attained in their time, to more or less authority as standard works on dentistry. Of these sixty-eight, fifty-two were written by graduates in medicine, sixteen by all others, and these of much the less importance and scientific value; and of the present standard works on the subject, the same large majority are the productions of medical men.

Another statement of the argument is this: Dentistry is a science requiring anatomical knowledge; such knowledge can be obtained in no way sufficiently without dissection of the parts operated upon. A student cannot be competent to dissect the head of a subject before he has the practice incident upon the dissection of the other parts of the body; therefore, no less than a thorough knowledge of anatomy will suffice. The same will apply in regard to Physiology, Chemistry, Pathology, Therapeutics, or Materia Medica. If a student will spend the same time in the study of the general principles of medicine as is commonly applied to dental specialties, he may become well versed in all branches of medical science, and then he will be able to pursue his special studies understandingly at his leisure. He cannot understand the whole without understanding the part. By attention

to the part only, he not only fails of the whole, but his knowledge of the part is limited and uncertain. It is needless for me to add that a practitioner to be a good *specialist* must first be a good *generalist*. A dentist may not be required to operate for strangulated hernia, perform ovariotomy, or ligate a femoral or carotid artery; neither may the ophthalmist or the aurist; yet I do not presume any member of our profession will claim that there is any better course for the latter to pursue than the full course duly ordained by our medical schools. Is not the operator who treats abscess, ranula and necrosis, excises tumors, and resects the maxillæ, in as much need of medical knowledge as he who cuts for cataract or enucleates the eye?

Obstetrics has been objected to as less necessary to the dentist than any other branch of medicine; but when it is remembered that during gestation, from conception to delivery, there is an immediate and constant change in the dentinal structures, and that during lactation there is a continual tendency towards disintegration, and that the dentist is continually called upon to operate upon the teeth of patients with these circumstances existing, will it be presumed that any needless knowledge of this subject will be acquired in an ordinary medical course?

The subject of anæsthetics needs only to be mentioned for every one to fully appreciate the importance of a thorough understanding of it. The nature of anæsthetics and their physiological action, normal and pathological, demands the most thorough knowledge of all the means to remedy their unpleasant or injurious action, and of all the measures for resuscitation from their excessive influence.

While the fact still remains that dentistry consists very largely of essentially mechanical operations upon the teeth, so far from this being a reason for less preparation, it is the strongest argument for the more thorough and extended preparation. Specialties tend strongly to run a practitioner in grooves, and the more of routine a specialty is, the more the need of the antidote.

The expediency of medical schools including dentistry in their courses of instruction may well receive from this Association a larger share of its attention; its importance seems to demand it. That such a course would be both expedient and wise, appears for the following reasons: More schools are needed, and more widely distributed, so as to offer more ready facilities and greater inducements to young men to obtain a good education before entering upon the practice of dentistry. Fewer schools and better, have

been advocated, that better instruction might be given. If such a result could reasonably follow, it might seem well, but the professors of existing schools are among the best men in the profession, and as many more can be found at call that will make equally good instructors, so there exists no lack of talent for professors. No one would think of increasing the aggregate number of attendants of common schools, academies, and colleges, by lessening the number of schools and colleges and instructors, but the rather where a few more scholars can be gathered together, there build another school-house.

Wherever a professional school of any kind is located, there will exist a higher standard of professional excellence, and an advanced public opinion upon the subject, and a keener appreciation of its worth; so wherever a dental school is established, there will be found superior operators and superior patients.

Increasing the number of dental schools does not lessen the attendance at previously existing institutions. The Baltimore college did not suffer by the opening of a school in Philadelphia, nor did the latter suffer in attendance by the establishing of one in New York City or Cincinnati, nor these by schools more recently opened; neither would any existing dental school suffer any lessening in its number of students should the door of every medical school in the land be opened to dental students to-day. The fact that not more than one in every six of the dentists of this country have had the benefit of any instruction outside of their preceptor's office, speaks more forcibly than I can write, for the necessity for greater facilities for professional education.

The faculties of our dental schools as a whole, are deserving of all honor for the faithfulness with which they have discharged their duty to their students, the profession and the public. They have advanced as fast and as far as the profession behind them would rally to their support, and have turned the examination screws upon their students as hard as they would bear, and I would be the last to cast a stone, but would rather seek to be an Aaron or a Hur to lift still higher the hands of each Moses, that they may lead the profession to greater victories.

The proposition to advise the including of dental subjects in a regular medical course, implies no reflection on our dental schools or their instructors, but the opposite. The advancement they have already made is, in including

more and more of general medicine in their courses of instruction, and in that direction it still must lie, until, sooner or later, they too cover the whole ground; and to this they are sure to come.

A thorough course in dentistry, according to the prescribed curriculum of our colleges, covers a term of three years, and a medical course the same. The ideal dentist will first graduate in medicine, and then take a post-graduate course in dentistry, making the whole term four or five years. But very few will do this, and for the present the profession will have to be content with the one or the other course. A course in medicine costs no more in time or money than one in dentistry. During the three years of a medical course there is ample time for a student to become familiar with the specialty of dentistry, or any other he may choose to practice.

The operative skill of the many dentists now practicing, whose preliminary qualifications are a medical education supplemented by an office practice only, is abundant evidence of the truth of the above proposition.

The few mechanical principles which govern the operation of filling a tooth can quickly be understood, and not many months of constant practice are requisite to acquire the art of their application. The same applies to artificial work. I mean such a knowledge as a student is expected to have at the commencement of his practice; the more perfect ability of the older practitioner can come only by assuming responsibilities, and overcoming difficulties by expedients developed from his own resources. I appeal to the experience of the very large proportion of dentists practicing at the present time with a preliminary studentship extending over practically less than one year, for evidence of the truth of this statement.

With the general medical principles involved in the practice of dentistry, the case is different. It is only by a prolonged effort extending over several years, that these can be required and understood in a sufficient degree for an intelligent application. And again I repeat: No amount of study of Dental Anatomy, Dental Physiology, Dental Pathology, Dental Therapeutics, Dental Hygiene or Dental Histology, will suffice to give a student more than a partial culture of which to boast, or by which to be benefitted. But let him master *general* Anatomy, Physiology, Pathology and Therapeutics, and the other branches of a medical course, and the special knowledge required, will be found contained therein, and will as naturally grow from it as the vigorous plant from the seed planted in fertile soil.

One more reason: Every person who studies dentistry is not well fitted by natural abilities for it, and if he possesses the liberal culture of a medical education, he is well able to correct the error of his youthful enthusiasm and seek some other branch of practice better suited to his abilities and tastes. On the other hand, if the principles of Dental Science are brought to the attention of medical students, many a man who might otherwise pass through life only a tolerable doctor, might become a brilliant dentist, and others whom nature had endowed with superior surgical talent, but circumstances offering no opportunity for their use, might find in dentistry a wide field for their development and exercise.

Will the medical profession take sufficient interest in the matter to extend their sympathy and support to such a cause, and will medical schools adopt such a plan, if requested?

Let the following history of a movement in this direction be the answer: At the semi-annual meeting of the Maine Dental Society, in February, 1876, resolutions were unanimously passed declaring a thorough medical education essential to the most successful practice of dentistry. Also, that it is expedient and for the best interests of all concerned, that existing medical schools should add efficient instruction in dentistry to their curriculum.

At the semi-annual meeting of the Merrimack Valley Dental Association, held in May, 1876, after a full discussion of the subject, resolutions expressing the same sentiments were passed by a unanimous vote.

The subject was brought to the attention of the American Academy of Dental Science, at their annual meeting in September, 1876, by a paper read before them, and upon taking a vote, the Academy unanimously endorsed the same resolutions and recommendations.

In December, 1876, at a regular monthly meeting, the Cumberland County (Maine) Medical Society considered this subject and without a dissenting or doubtful voice in the discussion or vote, declared for a more thorough education for dentists, and for affording medical students instruction in dentistry that they may not be debarred from entering the practice of so important a specialty of medicine. A committee was chosen to consider what action the society should take, and at the following meeting in January, 1877, the following report was made and adopted:

"*Whereas*, Dentistry is and should be regarded as a branch of the science of medicine, Therefore,

Resolved, That it is the duty of those having charge of our medical schools to see that suitable provision is made whereby all students attending the same may receive such instruction in this special branch as shall qualify them to commence its practice on their graduation.

Furthermore, we would advise that this subject be brought before our State Association at its next annual meeting, that it may take such action as it may deem advisable."

As a sequence of this action, the Portland School for Medical Instruction has added to its corps of teachers, Elbridge Bacon, M. D., for thirty years practicing dentistry, instructor in that branch.

The same committee was continued, to bring the subject to the attention of the Maine State Medical Association, and at its annual meeting last June the following action was taken:

"*Resolved*, That it is for the interest of the medical profession of this state that provision be made at the Maine Medical School whereby those students attending the same may receive such instruction in the special branch of dentistry as shall qualify them to commence its practice on their graduation."

As a conclusion of this report I offer the following preamble and resolutions for consideration by this Association, hoping they may pass by a vote as unanimous as those previously quoted:

Whereas, Dentistry is a specialty of the science of medicine,

Resolved, That we esteem a sound and thorough medical education essential for the most successful practice of it.

Resolved, That we deem it expedient and for the best interests of the profession of dentistry that existing medical schools enlarge their courses so as to include efficient instruction in dentistry, in order that it may be placed on an equality with other specialties of medicine.

[For action thereon see page 27.]

REPORT

ON

DENTAL EDUCATION.

By J. N. CROUSE, of the Committee.

Probably no subject connected with our profession has been so much written upon and discussed within the last few years with as few practical results as dental education. Reforms are needed, and if they are not brought about by this representative body, where shall we look for them? Our profession is constantly being filled up by a class of men who aspire to a profession, who have neither the brains nor the application to prepare themselves for professional work, hence they choose the dental above all others, as involving the least amount of time and exertion in preparation.

The subject of requiring a better preliminary education, both general and professional, on the part of those entering our ranks—how it can best be enforced, and also attained—is discussed and urged in our societies and journals from year to year, and with some good results. Still each year sees an increasing number of unqualified practitioners, with hardly the first principles of dentistry, entering the field to prey upon an undiscriminating public, and heap disgrace upon the profession. A large proportion of these have never attended a medical or dental college, nor had proper office instruction, and yet they take and hold a position alongside of the dental graduate, enjoying,

in many instances, the patronage of as intelligent people and as remunerative a practice. As fast as their patients discover they have been wronged, there are new victims ready for the slaughter. How is this growing evil to be remedied? A move was made in the right direction by this Association at its meeting two years ago, in so amending the constitution as to receive no delegate who enters the profession after that date, without having graduated at some reputable dental or medical college; also in the resolution passed recommending to local societies the adoption of rules prohibiting their members from taking students for less than three years. The Illinois State Society adopted this rule as an amendment to its constitution in 1873, with the addition that the preceptor require the student to give a written obligation to graduate at some regularly organized dental college, before he assumes the responsibility of a dental practitioner. But it remains for our colleges to strike still deeper at the root of this evil. Some of them have taken an advance step in adopting spring courses, the attendance on which, however, is left optional with the student. One of them has progressed still farther, in combining the two terms and compelling an attendance of an eight months' course. In order to enforce these rules upon the student, the advantages which our colleges offer, must be so great that students will feel that they cannot afford to do without them. But how are these advantages and facilities to be increased? We believe that our colleges are already doing all in their power, inadequately supported as they are.

Your committee on dental education for the year 1870, reported in favor of lessening the number of dental colleges. They urged that a few educational centers placed on a good financial basis, with ample facilities and appliances for instruction, and a complete corps of eminent professors, well compensated for their labor, could offer advantages to the dental student which our present schools cannot; that the colleges were too numerous to be well attended, and were hampered by limited facilities, and sustained largely by overworked professors, who gave not only their time, but largely of their means for their support. At that time there were nine dental colleges, with an average of three or four graduates for each professor. Since then the number of colleges has increased to twelve, with several more in an embryonic state. Your committee has not learned that the patronage has been so great as to demand or encourage this increase. The question arises, why are new colleges formed, to still farther hamper those already in existence and so poorly sustained? Are the projectors of each new college so philanthropic that they, too, are eager to make sacrifices for the profession? In short, is it to further the interests of the profession or to benefit the projectors? If they can offer increased

facilities for learning to the student, they do indeed benefit the profession; if they cannot, they are only hindrances to its progress.

There is probably no profession of which the public generally are so little informed as the dental, and in regard to which even the intelligent classes can be so readily deceived; therefore we must put a wider difference between the graduates which our colleges send forth, and those who are entering upon practice without the necessary preparation. We must make the standard of education in our colleges so high, and the examinations so severe, that to be a college graduate will mean something; that to be known as such will insure respect and inspire confidence in the mind of the public. Then will there be less temptation to young men to be dishonest, and a greater incentive to qualify themselves before entering upon professional work. Now while all honor is due to those who have toiled faithfully and conscientiously in our colleges, and have indeed sought to advance the interests of our profession, we long for the day when our dental schools shall be so manned and equipped, and the professors occupy such a position that they can instil in the minds of their students a higher appreciation of professional conduct. At present too large a per cent. of our graduates resort to unprofessional conduct as means of getting business. The instructors in our dental colleges should take special pains to guard this point.

Again, the selection of students is of the utmost importance. Let the requirements and advantages of our colleges be unsurpassed, and it avails nothing with dunces for students. A reform is needed in this direction, but difficult to make, from the fact that a large share of the students are taken by incompetent practitioners, who are not associated with any of our societies, and hence are beyond the control of the profession, or any restrictions that otherwise might be put upon them. Nothing short of legislation can reach them. The selection of students by this class of practitioners is generally purely mercenary, the object being to secure the services gratuitously, of an assistant and servant combined, and in many cases a fee besides. Prompted by such motives, they do not seek for intellect, or a high order of talent, for to such, the work of taking care of his preceptor's horse and cow, running of errands, collecting his bills, etc., would soon become monotonous, especially when he is paying for the privilege of doing it. Then, when doing the plaster work, finishing up rubber plates and polishing instruments, constitutes his laboratory instruction, and washing the dam, doing the malleting and keeping the office in order, his office instruction, the young man of any ability soon concludes

that he is being imposed upon; especially when he receives no other instruction. So young men of ability are rarely chosen to the position. The dolt who can be wheedled into the belief that he has only to perform these services faithfully for a few years, when he will come out a proficient in all the branches of dentistry, answers the purpose better. It may take the preceptor longer to teach his student these fine arts, but, all things considered, stupidity is an indispensable qualification. Dishonesty is not *always* the cause of such selection of students. The great need of our profession is, better material for dental students—the selection of none but young men of ability, who have the physical strength and general adaptation necessary for the calling.

Probably no one thing has conduced so much to the advancement of the profession at large, as Dental Societies. The clinics held in connection with them have been a power for good. Your committee think the practice of selecting and sending out a list of subjects for discussion without first getting papers pledged on each, a mistake. Each subject should be presented in a well-digested paper by some one who has given it thought, thus bringing the subject before the body in such a manner that it will take a wide range of discussion. The committee, or those having this matter in charge, should look well to this, and get papers pledged on each subject proposed for discussion, thus insuring a life and interest which otherwise will not exist. But with all that our societies can do and are doing, we cannot hope to be recognized by the other learned professions as an equal, until our colleges rest upon a different basis. But how to effect the change is a problem difficult to solve. Two great obstacles block the way, viz.: the multiplicity of colleges now existing, and the lack of means to place them on a good financial basis. If the first obstacle could be removed, it would greatly lessen the importance of the second; for the divided and sub-divided patronage which our colleges now receive, if given to the number of colleges actually needed, would place them on a firm financial footing. If the compensation then received from students, was not sufficient to amply repay the instructors, other means should be employed; for our colleges should receive the time and energies of the best talent in the profession.

We would suggest two other plans for improving our finances, for your consideration, viz.: endowments and state appropriations. If the number of colleges were reduced, the standard of collegiate education raised, and proper effort put forth, we believe endowments could be secured for such institutions. It might be more difficult to secure them in a profession like

ours, limited as to numbers and means, but if our colleges ranked with the best institutions of learning, as they should, wealth and patronage outside of the profession could be enlisted. But the more feasible plan, and one which we believe will ultimately be adopted, is, the securing of State appropriations. To the State of Michigan belongs the honor of being the first to make an appropriation for dental education.

We have said that our colleges should rank above the best institutions of learning; and why? For two reasons: until they do, and the graduates they send forth are superior to those of other schools, our profession will not receive the recognition which it desires; secondly, in an occupation so taxing, as ours, when once engaged in active practice, there is neither time nor inclination for hard scientific study; therefore the preliminary education should be more thorough, the foundation broader and deeper.

We respectfully submit this report, with the hope that this question of Dental Colleges, which is of such vital importance to dental education, may be discussed and rediscussed till some revolution shall be effected which will place our dental colleges foremost among educational institutions, and our profession in the front ranks of scientific bodies.

DISCUSSIONS.

Dr. Atkinson: With reference to the difference between a dental and medical education, there is only the difference between the human body and any one of its members. Until we can breed teeth without breeding them in connection with the whole system, we must acknowledge the unity of the body as not complete without the teeth, and not understandable unless we comprehend their connections and sympathies; and this mere verbiage of saying that there is a dental profession, as distinct from a knowledge of the science that underlies the ability to diagnose the cases—to prescribe the remedies, or execute the work, is sheer nonsense.

Dr. Taft: I know of no dental profession such as Dr. Atkinson has alluded to, nor dental education that is not based on medical science.

Dr. Spalding: That there is a *dental* profession distinct and *diverse* from the medical profession, I think no one will claim. Having failed to get what we have wanted, we are casting about to see what shall be done in the way of improvement; and, I believe this is the spirit that animates every man who thinks aloud on this subject. It is a very easy thing to beautifully paint with the pen a certain dental millennium, which no man of this generation will live to see, but the question is, how can we realize any such chimerical idea, for I cannot call it anything else; it is wholly impractical, and its realization is beyond the reach of the present generation, at least. Then, in making up our classes, we must make use of such material as now presents itself, for we cannot create it. If we make an ideal man, we make a very different one from the average of those that now present themselves. We can only select individuals from the mass of material at our command. And, when the time of graduation comes, we must set our standard of examinations at the very highest practical point attainable under our present conditions. We cannot expect young men to acquire knowledge without facilities, and therefore we must endeavor to prepare for them the best facilities we possibly can. I undertake to say that our medical schools, as at present constituted, are not the best means; hence there is only one opening left to us, and that is, to teach medicine in our dental colleges, from a dental standpoint. We do not propose to omit medical knowledge—do not propose to omit one single thing, not one iota of knowledge that is requisite for the dentist, but we propose to teach it from a dental standpoint. Our own individual experiences enable us to understand, much better than can a medical man, what is most requisite for us to know. If a dental student could comprehend and embrace the whole circle of knowledge, amen! say I. But if he is to be limited, and only able to comprehend a portion, let him have the most essential parts first, and then infuse into him a determination to make his studentship endure so long as life lasts, that he may constantly improve in that direction. No man's education is finished in a college; he must educate himself so long as he lives.

Dr. Barker: I have gotten entirely over this sickening sentimentality which prompts us to claim fellowship with a profession that utterly disclaims us. Let us become practical dentists, proud of the occupation, and not ashamed, at all times, to defend it and claim for it an

equal position with any other. I have only this to say with reference to some portions of the essay: it is perfectly natural and just that men young in the profession, knowing nothing at all of teaching, and the requirements of students, and having not the slightest conception of the material presented, should advance the utopian idea that a complete medical education ought to be acquired by dental students; and they ignore the fact that both of these would have to be acquired in the same time that is usually allotted to either one of them. We all know the tendency at the present time to division of labor and technical instruction. The University of Pennsylvania is now attempting to introduce special branches, to which special attention shall be given. Colleges abroad recognize only a few of the American institutions, and why? Because they are ephemeral, and they spring up like mushrooms. We all find that the more rapid the growth of the vegetable or animal, the more likely it will be to disintegrate and pass into certain forms of retrograde metamorphosis. The trouble is, that you ask colleges to do more than you are doing yourselves. Are the best men in the profession upholding the hands of your representatives? The colleges are the mouthpieces of the profession. I have had experience with medical men, and have seen very many start out with medical degrees, and afterwards take dental degrees. I say such men in my experience do not make as good dentists as if they had been thoroughly instructed in a dental college, and had received a dental degree first. I agree with one of the speakers who says there are too many colleges, and would like to see all the dental colleges wiped out, and two colleges established; and would have no one fill any chair unless he be a practical dentist.

Dr. Judd: This is a subject that should receive more attention than it has formerly, from this Association. There seems to be very diverse views with regard to several points connected with this discussion. We will, however, take it for granted that a large majority of the members of this Association are in favor of a high degree of learning. That seems to be a point upon which they may all meet; but the great point of discussion seems to be, how shall this be acquired. While one man says that in his opinion, medicine should be taught by dentists, another believes that medicine should be taught by medical men. I will not deny that there are dentists in this Association that are able to teach medicine, to a certain extent, but it would be very strange indeed if they should be better qualified to teach it than those who have made this the entire study of their lives. It would be equally strange if our young dental colleges could teach medicine better than colleges that date back for centuries, and have brought to their

assistance the best talent, the largest learning, and the greatest experience that can be found in this or any other country. Again, is it necessary for us to know anything about medicine? Then comes another point: shall all of our learning be from a dental standpoint, as has been stated? During the past three or four days the most of our time has been consumed in the discussion of medical subjects—subjects which are connected with the treatment and the cure of disease. These are what we need the most, to complete our dental education. The manipulations are taught in every little Association of dentists throughout the land, and the general theories connected with them are well understood. But these medical subjects, less understood, have been found of so great importance that we have given almost all our time to their discussion. In my first valedictory before the graduates of the Missouri Dental College, I stated, that so far as medicine and dentistry go together, it is well to make use of the learning and the experience of the medical teacher; and when we diverge from that, let the dentist furnish the dental instructions, teaching dentistry just as any other specialty is taught. I must confess that my experience with medical men is widely different from the experience of my friend Dr. Barker. In the relations of life, wherever I have met them, I have been treated with as much courtesy and kindness as I have ever been by the members of the dental profession.

Dr. Barker: I did not refer to any social relations—these are of the most delightful nature—but of professional.

Dr. Black: In my opinion a dental student should study Anatomy, Histology, Physiology, Pathology, Therapeutics, Chemistry and Surgery. Are not all these subjects taught as well, and better, than we can hope to teach them in purely dental schools, in our medical schools that have been in existence for years, and where the best skill in the world is concentrated? What do we want besides this? Metallurgy and mechanics. Does not that complete the course? Can't it all be placed under these general heads? If we are going to cut loose from the medical profession, we must reduce ourselves simply to mechanics; that would be the necessary result, for we are medical men, or we are mechanics. The surgeon is necessarily more or less a mechanic. If we are going to be mere fillers of teeth, let us say so, and give over the treatment of disease to medical men; otherwise let us prepare our students for its intelligent treatment, and I know of no better place to acquire a qualification for this than in a medical college.

DR. INGERSOLL: As I understand the report which has been read, it proposes to ask of the medical profession a practical recognition of dentistry as a specialty of medicine, at par with the specialties of the surgeon, the oculist and the aurist. Regard dentistry as *we* may, it is not *in fact* regarded as a specialty of medicine. As a practical science it is nowhere found in text-books of medicine, and is wholly ignored by the medical faculty. The science of medicine in its broad and true sense embraces the entire human organism, and takes cognizance of all its physical relations. It therefore *technically* includes dentistry, while it practically ignores it. If now it shall extend its college curriculum and teach dentistry as a specialty, like the specialties of the surgeon, the oculist, and the aurist, the community will consider the graduate from the medical school as well qualified to practice dentistry as surgery—as well qualified to treat the diseases of the teeth as the diseases of the eye. The many hundreds of graduates from the medical schools of our country would go forth as practicing dentists, and the dental profession as a distinct body would be swallowed up, and cease its separate existence; I am not yet prepared for this.

DR. FILLEBROWN: In the time allowed for my report I could not presume to rehearse all the arguments relating to the subject. Medical schools are not at the present time so constituted as to properly instruct in dentistry. That they must be reconstructed there is no question. It has never entered my mind, nor have I ever heard it intimated, that any person not in the active practice of dentistry should attempt to give instruction in that branch. The same does not apply to anatomy, materia medica or chemistry. If a person well understands general anatomy, and wishes to pursue dental anatomy as a special study, he has already the basis from which to start. With regard to over-education, I believe there is such a thing; but is three years an over-education? Not by any means. In this country this is the minimum amount of time that is usually spent upon medical education before graduation, and I do not believe that Prof. Huxley, or any one else, thinks that an over-education.

DR. ATKINSON: He takes seven years as the minimum.

DR. FILLEBROWN: I want no sudden growth of new schools. I speak of medical schools enlarging so as to include dental instruction, because they would not be new schools, but are old schools well founded upon the respect and confidence of the public. Why should not the medical schools of Chicago, for instance, which are well established in this

community, well supplied with property, with appliances, and with intelligent and skillful professors, add to these, instructors in dentistry, and thus include this important specialty in their courses? They have only to issue the call, and the goodly city of Chicago will forthwith furnish practicing dentists well worthy to be associates in their labor.

Dr. Crouse: It strikes me that the question for us to consider is not what the medical profession are doing—not how many quacks they may send out, nor how efficient the medical student may or may not become—but rather what we ourselves are to be. The medical schools are so numerous, and the competition so great, and the talent employed in them is so small in many instances, that we do not find in them just what we want for our dental pupils; so I do not care much about discussing the conveniences of these institutions. I have known practitioners of medicine in the country wholly incompetent, and such is the case in all professions. It is absurd to talk about general practitioners being able to treat the eye, or the ear, who cannot, as young graduates, treat anything properly. Some after several years' experience and through many mistakes, acquire a fair degree of skill, and have ambition enough to go on and finish their course of study in some more reputable schools; while a great many others get disgusted with their blunders, and go at something else, and it is a good thing for the community that they do. That is the general history of medical education in this country. There are, however, some grand exceptions. We have a few medical schools which send out their pupils well prepared. That is what *we* want. There is one question I would like to ask of any practitioner here who has been in practice long enough to find out, namely, if he had his course to take over again, whether it would be a less or a more thorough one. If they feel as I do, they would say it would be very much more thorough; they would not be in such a hurry to get into active practice.

Dr. Spalding: We would infer from the tenor of the arguments which have been advanced upon this subject, that the advocates of dental schools are opposed to medical education. It is the most absurd position that ever was assumed, for there is no dental educator in this land who is not a friend to education in medicine, and who does not insist that every student in the dental schools shall be educated in medicine just as far as it is practicable—not what we would desire, not what we some day hope to see, but what is practicable. At the present time we have got to take things as they are, and make the best of them. If we could change our circumstances to suit ourselves, we would have a very different condition of things, and

would insist that every student should take a complete course of both medical and dental study. This is now possible to only a few, therefore we cannot enforce any such rule. I regret exceedingly that there has been an effort here to antagonize these two institutions of learning, dental and medical. But that you can make good dentists in medical schools, either as these schools are at present constituted, or as they are likely to be in the near future, looks to me entirely utopian.

REPORT OF THE COMMITTEE

ON

DENTAL LITERATURE.

By W. A. BRONSON, Chairman.

The rise and progress of dentistry in the United States has been an object of admiration to the profession for many years. Again and again has the small seed planted an hundred years ago, been compared with the wide-spreading tree of to-day; and loud and long have been the pæans of congratulations from all parts of our country.

That there is much cause for this rejoicing, cannot be, nor has it ever been, denied. The growth of an art which, scarcely a century old, numbers its present ten thousand votaries—and that despite the inherent difficulties and obstacles in the way of its successful acquirement and practice—may certainly be matter for wonder.

It is not the province of this report to explain such rapid growth, or to consider the steps by which dentistry has arrived at its present importance, numerically, and as one of the healing arts. Still, as introductory to the views hereafter advanced, it is requisite to inquire somewhat into those circumstances which form the foundation for the oft-repeated gratulatory remarks on the rise and progress of American dentistry.

Careful observation of the written and oral efforts on this subject, during many years past, will, it is thought, establish as a fact that the *results* of our professional skill have been very much more thought of and spoken about, than the occult causes which have produced those conditions which it has been our endeavor to remedy. The cure of a dental disease, the re-establishment in health of an ailing organ, or the mechanical restoration of a partially or wholly destroyed one—such are the things which have long seemed to fill the eye of dentistry, to the almost utter exclusion of other and equally important objects of study. The discovery of *causes* appears to have become subordinated to the observation of *effects;* or, in other words, practical dental art appears to have made enormous strides in advance, while theoretical dental science has, to say the least, not kept pace with that branch of professional effort by which it should have been followed, not preceded.

Such a conclusion, it may be said, is always inseparable from the first growth of any science. This is, indeed, as true as it is unavoidable; for it is only by observation of daily recurring effects that a knowledge and appreciation of their causes is to be obtained. Still, it is equally a truth in the history of general science, that the ultimate aim of the student has been, not simply to accumulate facts, but to evolve causes from effects, wherever and whenever such effects have been encountered; and thus to lay a substructure of theoretical conclusions by which to govern further observation intelligently, and explain further and new facts correctly.

The permanent literature of any science—the literature having the most lasting and powerful effect for good on that science—is the literature which treats of cause rather than effect—that which gives reasons, rather than that which describes results. Any science or art possessing a copious and deeply-studied literature of the first kind, has abundant reason for self-gratulation; since it then holds, within itself, the seeds of further healthy advancement, and possesses a foundation of truth which nothing but the grossest neglect of the principles thus inculcated can ever destroy, or even injure. Now let us ask ourselves, can such a literature be said to belong to, or to have been the fruit of, American dentistry?

The dearth of strictly scientific dental books must be deplored by all who wish scientific prosperity and value to the future of the profession; and the appearance of each of such works will be proper occasion for congratulation on the part of all dentists. Of such a character is a work which has

been published in London since the last meeting of this Association—the "Manual of Dental Anatomy, Human and Comparative," of Charles S. Tomes.

This work is intended only as a students' manual. In the words of the author's preface, "I have long been embarrassed by the want of any manual sufficiently recent to embody the advances which have been made of late years, and yet not too comprehensive in its scope, which I could recommend students to adopt as a text-book; in writing this volume my endeavor has been to supply this want." Yet, despite its humble pretensions, the book is eminently adapted to the wants of practical men in our profession. A dearth of knowledge of comparative dental anatomy, appears, among us, to be joined to (as it is the certain cause of,) a great want of appreciation of the importance to us, as scientists, of the subject. It is true, teeth may be filled, and many other dental operations successfully performed, without any very intimate knowledge of the causes of those organic disturbances which we are called upon to correct; yet any sufficient acquaintance with the origin and occult operations of disease can be attained only through deeper channels of observation and study than can be had through the most careful inspection of superficial results.

It has been said, that thoroughness in any one science can be had only through an intimate knowledge of all the others. Without going so far as this, it is certainly safe to say, that acquaintance with the anatomy of other animals than the human, is of vast importance in the study of the structural functions of the latter. Thus it is, that the work before us takes on so much of value in the estimation of the dental student.

Without attempting any extended or particular examination of this work—a labor which the committee feels, indeed, unable properly to perform—it may be noted that some parts of the book, and notably the sixth and seventh chapters, on the teeth of fishes and reptiles, are to be considered as mainly the results of original investigation and discovery on the part of the author. As such, they reflect great credit upon him, and through him upon the profession. It is true that these results of his labors in this direction may appear, to the careless eye, somewhat meagre; but he who is accustomed to scientific research is well aware that the value or importance of discoveries and deductions is not always directly proportional to their apparent extent. Any steps into the hitherto almost neglected field of investigation offered by the development of piscine and

reptilian teeth, must be regarded with interest by the intelligent observer; and we must thank the author for the enterprise and spirit of careful study displayed in thus even attempting to fill the hiatus which has hitherto existed in this direction. That the labor thus expended will be productive of excellent return cannot be doubted; even if it serves only to direct scientific attention more steadfastly to the subject.

In the remainder of the work, the author has, as he states, "freely used whatever material was available." He further adds: "Some little resemblance will be found between portions of this volume (especially Chapter V, on the development of the jaws and teeth,) and portions of my father's 'Dental Surgery,' which, in the absence at the time it was written, of any recent work on dental anatomy, contained a great deal which was more strictly related to this section of the subject; and the resemblance was the less avoidable, inasmuch as the 'Dental Surgery' was revised and added to by myself, three years ago."

Yet it must not be supposed, from this, that the book is in any respect a copy or rehash of any other dental work. On the contrary, perhaps its greatest merit lies in the fact that it embodies the principal, at least, of those "recent accessions to our knowledge which are nowhere else to be found in a collected form, but which must be sought for in the pages of various original memoirs, some of them not very accessible."

Regarded in this light the work before us is of very great value, both to the student and the practitioner of dental science; and must undoubtedly attain to importance as a text-book and manual of reference.

The profession is already familiar with the work on "Operative Dentistry" by Prof. J. Taft. This book is again presented to us this year, in the form of a third edition, thoroughly revised, and considerably enlarged. As a text-book for the student, it is undoubtedly of great value, since the minutiæ of operations are explained with care and clearness, and the theories of disease and methods pretty well stated. The objections which laid against the previous editions as works of *scientific* authority, however, hold good also as regards the last edition. The book, while presenting excellently well the *alpha* of professional acquisitions, and even something more, cannot be said to attain their *omega*. Perhaps, when the subject itself is carefully reviewed, such a result may be said to be impossible; therefore the work must be considered as having received the highest praise when it

is said that, as a text-book for the student of operative dentistry, it as yet stands alone. An appendix of twenty-five pages has been added in this edition, consisting of an extract on "Dental Caries" from "Watts' Chemical Essays;" a somewhat needlessly lengthy and minute description of Dr. Corydon Palmer's plugging instruments; a history and description of Dr. Bonwill's electro-magnetic mallet, Dr. Buckingham's engine plugger, Hyde's pneumatic mallet, and Dr. Louis Jack's matrices; and extracts from medical journals on salicylic acid. It is still stated (Page 205) that Dr. Atkinson introduced the use of the mallet to the profession, in despite of well-known proof and Dr. Atkinson's oft repeated assertions to the contrary. This is an error which there is hardly any excuse for perpetuating. While hand-filling has received, as it properly should, careful and exhaustive treatment, the methods of mallet-filling, particularly as connected with the use of the various automatic instruments now so well-known and widely employed, are hardly noticed. Certainly the general principles of filling, as illustrated, might be sufficient to guide the learner to a proper use of these instruments; but there are certain minutiæ of methods and devices which, if treated of, would have made the work more complete, and added much to its value.

This work is so widely and thoroughly known, that any exhaustive review of its contents is entirely unnecessary. We therefore pass to a consideration of the published Transactions of the various societies, which demand notice as of much and steadily increasing literary value. The production of so great an amount of serviceable material as annually appears in this form is certainly matter for felicitation. The many essays and the discussions thereon, while of exceedingly various merit, still must constitute a large amount of information, which, once freed from a great deal of extraneous, often irrelevant, and occasionally worthless, matter, would undoubtedly greatly benefit not only the student in dentistry, but the advanced and scientific practitioner. Doubtless one is often tempted, on reading lengthy papers and interminable discussions on topics long worn threadbare and never of any great importance, to desire a somewhat higher standard of subject, and a stricter censorship over publication than is evinced by much of the literature of societies. Also, it seems deplorable that so much time and ability are exhausted in our meetings on little matters of mechanical execution, or such slight changes or adaptations of operative ability as are constantly occurring in the daily practice of all our skilled men; as if the *manner* rather than the *matter* of the operation was the point of greatest import. Still, these are things inseparable from juvenes-

cence, and the youth of the profession will lead us to excuse much, while constantly teaching us to expect better things.

Much has been written and said on the subject of periodical dental literature, and many and various the opinions expressed in its regard. The extremes may be thus illustrated: on the one hand it has been asserted that the non-advance of dentistry in essentials—the tendency so widely exhibited toward skill in mechanical ability, and deftness of execution in operations—is directly and distinctly traceable to the fact that all (or, at least, the most important of) our periodicals are published by, and in the interests of, the various dental manufacturers. On the other hand, it is as confidently affirmed that to dental periodicals in the hands of dental manufacturers must be attributed almost all the advance of dentistry within the past thirty years. The first assertion is equivalent to stating that the dental manufacturer is a drag on the real progress of dentistry, while the second almost directly asserts that dentistry advances only by the aid or sufferance of that individual. It will be seen that the real difference between these disputants is not in the fact of advance or retrogression, but in the peculiar significance attached by each to the word "advancement." As is usual in such discussions, neither of the extremists is wholly correct; while it is also true that each has some grounds for his peculiar conclusions. It is undeniably a fact that mechanical appliances have grown in number and importance chiefly through their extensive advertisement in the columns of the dental journals. No individual exhibitions, no appearances before Societies, could have alone let loose upon our profession the deluge of machinery and materials under which it at present labors. It is also susceptible of demonstration that an excess of such material (formed quite as often solely for the saving of labor as for conducing to excellence of workmanship,) must inevitably tend to lower the standard of scientific attainment, although, perhaps, increasing the artistic beauty of some of our professional performances. This, it is claimed, is one of the methods by which scientific dentistry has been belittled through the exertions of our manufacturers, and forms, in fact, one of the chiefest bones of contention between those who decry the degree of D. D. S., and those who hold that of M. D. as useless to dentists. Indeed, the inelegant term of "tooth-carpenter" is somewhat too familiar to our ears.

It must be conceded that a multiplicity of instruments and materials may be so applied as to aid and further the deepest scientific research. It is, in truth, in the *manner* of *application* of our aids, rather than in the aids

themselves, that the true difference between the scientist and the routinist is to be found. Yet, candor and experience compel the conclusion, that an excess of tools and a glut of materials will certainly form, at least to the man of ordinary mould, a very troublesome barrier to depth of thought or profundity of abstract enquiry. Dr. Wollaston, when once asked to exhibit the laboratory whence so many of his great chemical discoveries had proceeded, and which was supposed to be very extensive and complete in apparatus, showed, to his enquirer's astonishment, a few watch-glasses and test tubes, with a very limited amount of chemicals, as the materials whence came his deductions.

Again the general character of the literary efforts to be found in our dental journals, is certainly not of the highest; and this deficiency in standard is easily discovered to proceed from the impossibility of severe censorship inseparable from such publications. A habit of writing, with facility for publishing, begets only a certain smoothness of language, and does not further depth of thought. It has been again and again laid down as an unexceptional rule by the masters of general literature, that a subject should not be written upon until it has been deeply considered and thoroughly matured in the mind. How much more strictly should this apply to printing what has been written? Yet, a temptation to get into print is sometimes powerful; and the facility offered for this by a public journal is taken advantage of, doubtless oftener than should be the case. Thus it happens that our journals, while containing much valuable material, admit also even more that is worse than useless. The effect of such lucubrations on young or untutored minds is evident and deplorable. A habit of superficiality, once contracted, is almost impossible to be thrown off, especially as regards scientific study.

Per contra to all this, it is undoubtedly true that through interchange of opinion and thought in the columns of the dental journals, and the general publicity given to much that would be otherwise of only local value, modern dentistry has made very great progress; indeed, so much, that it is difficult to determine whether the advantages thus gained do not balance all the harm which may have occurred from other circumstances. Yet this very fact is an argument in favor of better and higher-graded professional journalism; for, if so much good has been done by the present methods, despite all the harmful and even degrading influences inevitably consequent on those methods, how much more valuable will be that system of dental periodicals which shall promulgate only the good and the true, elevate

science as well as increase skill, and improve the mind while directing the fingers? Such is a system of dental journalism which must be looked for in the future, since it is certain that it has not yet appeared in the past.

There may appear in this report much more having reference to the literature of the future than to that of the present. If so, then the intention of this writing has been successfully effected. The reason is that the condition of our present literature seems to indicate, more than anything else, a necessity for reform. Such reform, to be of any permanent value, must be general, not specific. It is the whole character of our writings which needs to be changed. Things written, spoken, or printed, are worthless, or worse than worthless, unless predicated upon the sure and solid foundations of accuracy in observation and correctness of judgment. Our energies should not be frittered away upon matters of local or of only specific importance. The principles upon which we found our achievements should constitute matter for our writings, discussions and congratulations, rather than the achievements themselves. Causes should be searched for and understood, while effects should assume a secondary place. Actual scientific efficiency should rank higher than manual dexterity. The committee may be accused of criticism; but so long as the ends enumerated are unattained, criticism can never be useless.

REPORT OF THE COMMITTEE

ON

ETIOLOGY.

By D. C. HAWXHURST, Chairman.

In reporting on the subject of Etiology, I raise the question of Disuse in its Relations to Integrity of Structure in the Tissues of the Teeth.

The first result of lessened functional activity in an organ is a decline of vital resistance; then follows a downward modification of structure. What will be the result of this, if long continued? Will the effect be transmitted to descendants, and, by cumulative heredity, produce a permanent deterioration of tooth substance?

In my report on Etiology for 1876, I had occasion to make record of the fact that the jaws and teeth, their moving muscles and the facial bones in general, are smaller in civilized nations than in their savage ancestors. This question being one of simple observation on comparison of skulls, is not open to discussion. As an observed fact, it chiefly concerns us to-day as a point of departure. We may then ask what causes have been at work to produce such a result? What is their mode of action, and *what is likely to be their effect on the structural integrity of the dental tissue?*

Before answering these questions I want to say that the necessity of undertaking this inquiry, as of all studies into the predisposing causes of caries, arises from the fact that what we know of the direct agent of decay, does not enable us to account for all the phenomena. There is a missing factor, and that is to be found in the character—whether sound or defective—of the tissues that compose the teeth. Indeed the profession has of late given much attention to defects of structure in enamel and dentine, whereby these tissues possess a diminished capacity to resist the direct agents of decay. I make but the briefest enumerations of important deviations from sound structure.

The dentinal tubes that may normally pass a little way into the enamel, often abnormally expand into long cells reaching nearly to the enamel surface, rendering it porous. The enamel may be granular, or each fiber may be defective at the middle line of its axis, or, being solid, contiguous fibers may be un-united to their fellows. The enamel may be pitted and grooved, it may be honey-combed and irregular; between the cusps it may be fissured, furrowed, cracked and porous. In the dentine there may be an imperfect fusion of its calcification globules, resulting in the extremely damaging interglobular spaces. The dentinal tubules may be abnormally large, rendering it porous and liable to rapid decay.

Without attempting to ascertain how much of this defectiveness of tissue is due to a lack of phosphatic salts in food, or to other causes that may disturb dentition, it will answer the purposes of this inquiry if it shall appear that *somewhat of it is due to a lessened functional activity of the dental apparatus itself*, extending over a long period, and gradually reducing formative vitality and structural integrity. Of course, any effect that partial abolition of function can have on the teeth, must fall under the general law, that use develops and strengthens, while inaction weakens. It may be instructive to examine two or three instances wherein its action has been pushed to extremity.

It is a general truth of biology that nature pulls down and absorbs away organs whose functions have been abolished; or, in other words, that structure and function must coincide. If *disuse* is but *slightly* brought into play, the structural modification will be proportionately small; as in the common domestic duck, whose wing bones "weigh *less* and the leg bones *more* in proportion to the whole skeleton, than do the same bones in the wild duck." The fact that the domestic duck *flies less*, and *walks more*, than

its wild progenitors, is a sufficient cause of this relative difference. It is plain that a persistence of similar conditions would still further reduce the weight of wing bones, and power of flight, in the domestic duck. (See Darwin's *Origin of Species.*) In several families of wild birds the same thing has happened, and atrophy of the wings has rendered them incapable of flight. On several lonely oceanic islands, in the midst of a peaceful environment, there have been found several large ground-feeding birds that have entirely lost the power of flying. Neglect of flying has in these cases been followed by atrophy of the flying organs. (Darwin's *Origin of Species*, Page 108.) In several genera of beetles is repeated the spectacle that we have just seen in flightless birds. The entire family of *Staphalinæ* have lost the power of flying, and exhibit their flying apparatus in a more or less atrophied condition—the wings reduced to rudiments, and the wing covers consolidated. The only tenable explanation here is, that the mode of life in which these animals differ from the other members of their order and class, gradually superinduced in their flying ancestry the habit of not flying, and, at the same time, atrophy of the organs of flight.

If now it should appear that our sound toothed but savage ancestry, gradually discarded a coarse and resistent regimen for soft-cooked food, superinducing the habit of chewing more lightly, may it not be safely questioned whether we, their descendants, are not suffering from the earlier stages of dental atrophy? I do not forget that there must necessarily result a different kind of atrophy in flinty organs like the teeth, from that of parts which circulate the blood corpuscle, and that in many ways the action would be different. Some of the differences, I hope, will appear later.

It is at once apparent that there can be no atrophy of a hard structure that suffers no interstitial change. The results will therefore be due to changes in the soft parts in connection, and a consequent effect on progeny. In the above cases we have seen an essential organ of the animal body rendered functionless by disuse, and reduced to a rudimentary state. I now present you a case in which an organ, quite as important as the wing, has been so completely atrophied from disuse that not even a rudiment is left. This has occurred in a genus of lizards, the *Anguis fragilis.* This quadruped, which once made its way by means of four well-developed legs, has suffered their entire loss through having gradually adopted a changed mode of locomotion. This change of habit, no doubt, grew out of some slow modification of its food-procuring habits, whereby its mode of progression came not to be effected by exercise of the legs. Through this agency, the

stimulus of use was gradually withdrawn from the limbs; they dwindled to the condition of useless appendages, and were after a time abolished by atrophy. (See *Descent and Darwinism*—Schmidt, Page 185.)

Two other genera of lizards exhibit these animals in a state of transition. In the *Chirotes*, the hind legs are abolished, while the fore legs remain. In the *Pseudopus*, the fore legs have been entirely suppressed, and the hind legs exist but as useless rudiments. That these animals once had four legs, has been proved by Furbringer from an examination of the pelvic arches and sternum, and from the history of their development. It will be at once recognized that an organ so important as the leg, must have been long in undergoing complete abolition. Perhaps many thousands of generations of cumulative hereditary atrophy were required; although it must be acknowledged that soft parts like muscles and nerves, and comparatively soft parts, like bone, which freely circulate blood, will dwindle from disuse faster than the dense structures of the teeth.

Without multiplying illustrations needlessly, I may say that a large number of cave animals and insects, both in this country and in Europe, have suffered atrophy of the eyes from disuse. In one, the crab, the eye-stalk remains to tell the story, though the lenses have been absorbed. In every class of animals are the remains of organs that were once fitted for vigorous actions. Not one of the higher animals but exhibits rudiments of organs that were needed to adapt it to a different order of things in a remote age. (See Darwin's *Origin of Species* on the Atrophy of Organs.)

In the cases already given, the atrophy and abortion of organs has taken place in parts which circulate blood freely, and which are therefore speedily sensitive to any change in the force and rapidity of the vital currents. The shrinkage and atrophy of these parts, with final abortion, is unattended by such impairment of structure as to cause the organ to crumble, dissolve, or exhibit a solution of continuity. The effect of disuse is, however, very different on the denser tissues, such as the horny structures of insects, and the teeth of animals. Disuse of these structures is not followed by immediate shrinkage, but rather by slow decrease, in the succession of generations, and impairment of developmental processes, resulting in a state of frailty or tissual infirmity, which is proportionate to the atrophy. Such hard structures, when so atrophied, if subjected to force, easily give way, and if to the

disintegrating action of chemical agents, are more quickly broken down than perfectly developed tissues. But this will not be true of atrophied soft parts. Soft tissue while undergoing interstitial change, hugs close to the ebbing vital currents, shrinking down to dimensions small enough to keep its substance good.

To illustrate this principle, I make brief reference to certain beetles, of which there are several genera that exhibit atrophied hard structures, with defectiveness of tissue. In the males, the horny anterior tarsi, or feet, exist in a rudimentary state. These feet appear to be of little use to the beetle, and almost invariably fall off entirely at an early age, their absence appearing to cause the animal little inconvenience. The *Onites apelles* has been thought to be entirely without these anterior feet, but further investigation has shown that they exist in the young, though they crumble away with advancing age. Thus it seems that these *tarsi* cannot be of much importance, or be much used by the beetle, and that they are in process of abortion. (See Darwin's *Origin of Species.*) In an allied genus, the *Ateuchus*, their entire abolition has taken place, and it is born with its two front legs footless, which is of little consequence, since it has four strong feet left. The point of interest in these beetles is the mutilation which almost invariably occurs in the rudimentary hard tissues of the *tarsi*, furnishing an illustration of the principle, that while soft parts may respond to abolished function by dwindling to smaller dimensions, non-vascular parts make their first response by deterioration of structure.

An interesting instance of the disappearance of an organ made of dense tissue is found in a marine crustaceon, the Cirripede. (Darwin's *Origin of Species*, Page 136.) This animal has a shell which consists of the three anterior segments of the head enormously developed, and supplied with nerves and heavy muscles for opening and closing. These calcareous plates are reduced gradually to a slight rudiment, when the animal comes not to need such protection. This happens when the cirripede becomes parasitic, and borrows protection from the shell of a neighbor. One genus, the *Protelepas*, thus loses almost completely its calcareous shell, and also the great muscles that close it. (See Spencer's *Biology*, Vol. I, Page 184.) I have been unable to learn as a matter of fact whether the carapace or shell of this parasitic cirripede conforms to the law, that dense structures, in becoming rudimentary, exhibit defective tissue. This is, however, almost certain to be the case on *a priori* grounds.

Coming now to rudimentary teeth, the tusk of a species of elephant in Ceylon deserves especial study. The organ has not only become rudimentary, but has been entirely suppressed in the large majority of the animals. The few that possess them, however, are invariably males, in whom they are reduced and imperfect. (See T. Emmerson Tennent's *Ceylon*, 1859, Vol. II, Page 274, or Darwin's *Descent of Man.*) There is also an antelope *Antelope montana*, in which the canine teeth exist only as rudiments in the young male, and disappear in the adult state. They are infirm, and of little use. They are absent in the female at all ages; but the females of certain other antelopes have been known to occasionally exhibit rudiments of these teeth. To show how the rudimentary condition of this tooth is related to its disuse, it should be remembered that in ruminant animals "the development of the horns generally stands in an inverse ratio to that of the canine teeth." (See Darwin's *Descent of Man*, Vol. II, Page 246.) The cause of this is plain. Since a ruminant animal does not generally use the canines for any purpose but fighting, the development of horns would render this tooth useless, and it would dwindle through disuse (as has happened in many animals), or might never come into existence if the horns were developed first. The rule has some exceptions. But a withdrawal of the *stimulus of use* has not only permitted the teeth to fall backwards in size and function to the position of rudimentary organs; it has gone further. In a few instances it has resulted in the gradual but complete disappearance of the dental apparatus by atrophy. It might have been convenient to present this class of cases first of all, but it was necessary to consider organs in their various stages of progress towards extinction in order to show their defects of structure.

The active suppression of the teeth in at least two members of the vertebrata has been pointed out by Mr. Darwin, who instances certain whales that have not a tooth in their jaws in maturity, but exhibit teeth in their fœtal condition. In this case, as Mr. Darwin has shown, not even temporary functions can be assigned for these organs, which are first built up and then pulled down again. (See Spencer's *Biology*, Chapter V, Page 364.) They are absolutely without any function, and are absorbed away before the animal is born into the world, where it might have used them. It is obvious that this trace of a dental system must have descended from some ancestral progenitor supplied with teeth. Disuse and the continued transmission of acquired and inherited weakness had, after perhaps countless generations, rendered the whale edentulous. Analagous to the above is the discovery of rudiments of teeth in the beaks of the embryos of certain birds. Bearing

in mind the fact that the embryo passes in its development, through a series of states representing more or less distinctly the condition of its ancestors, we must conclude that these birds were descended from ancestral forms having tooth-bearing jaws, and that the long persistence of conditions unfavorable to the development and nutrition of the teeth has resulted in their suppression. (See Von Baer on Embryology.) It would be interesting, were there time, to study the teeth of whales still further. In many of them, rudimentary teeth exist after birth, but are lost in adult life. In others they persist in a stunted and ineffective condition to adulthood. In some species, certain members of the dental series have been dropped, as man is now losing the wisdom teeth. (See Tomes' *Dental Anatomy*, Page 287.)

Whether the human teeth have already felt the influence of beginning atrophy, is a question of great importance, and one that lies at the very foundation of the researches undertaken in this paper. The fact that they are not holding their own, but, like the jaws, are gradually losing in size and weight with the advance of civilization, must indicate that they are already in those earlier stages of decline that precede and lead to the rudimentary state. As confirmatory of this, it may be noted that they are already beginning to exhibit those defects of tissue that characterize the rudimentary state of hard organs, as well as that occasional eruption late in life, or at times non-eruption, which in the lower animals has been found to be the harbinger of final suppression. Different members of the dental series in man are differently acted upon. I made a report to this Association last year on the modifications of the wisdom tooth. A similar study remains to be made on each member of the series. It appears that several are failing more rapidly than the remainder, which is due to the varying stimulus of use, on account of difference of position in the dental series

It remains for us now to consider the special forces that have acted for an extended period upon the teeth of mankind. That savage nations feed differently from the more cultivated, is plain; and that the food of tribes in a savage or semi-civilized state, demands a relatively larger amount of mastication, all writers and travelers have agreed upon. To what extent alternations of pressure and hard usage, calling the blood to the parts, has been abolished by modern cookery, I cannot decide. But I know that we have little now to do in mastication but to move the jaws. The teeth are seldom firmly pressed into their sockets and made to feel the reactive stress of their proper functional activity. Thus, neither the jaws nor teeth are as abundantly

supplied with blood and nutritive pabulum in civilized, as in savage races. A decline in development must be the sure result.

This change of habit must have gradually produced physiological and structural decline in the individual. It is the province of heredity to transmit these to descendants, and to add to them so long as their cause remains in action; for heredity tends to transmit to descendants the whole nature of their progenitors; not only their points of strength, but also their weaknesses; not only sound tissues, but also those which are the subject of deterioration. "The blind fatality of its laws regulates not alone progress, but also decay." (See *Heredity*, by Th. Ribot.)

It thus appears that the inherited defects of countless generations slumber in the teeth of the Anglo-saxon, ready to be developed by favoring conditions. His fast decaying teeth carry in their tissues a record of the gradually induced atrophy of a long line of progenitors, reaching backward into the pre-historic ages, when the first fire was built, and cookery began. The present state of these organs is the result of innumerable modifications of tissue in the direction of defect, slowly accumulated as the generations passed on, and added to by improvements in the art of cookery and the invention of new luxuries.

I would not be oblivious to the existence of direct agents of decay, nor the constitutional causes that act in special cases. I seek only to make record of a cause which has been able, I fear, to introduce gradually into an originally impregnable tooth-structure, a source of widespread structural infirmity that is able to render the direct agents of decay far more injurious.

REPORT ON ETIOLOGY.

By MARSHALL H. WEBB, of the Committee.

When pabulum of the proper quantity and quality is normally appropriated by the cells, they construct perfect tissues. Regular aggregation of atoms, and perfect molecular and granular arrangement, (which manifestation is but the assertion of the typal presence resident within and about each cell, and aggregation of cells), not only brings about normal development of tissues. but of organs also, and these, embodied, constitute a system. Anything that interferes with the richness, or the due supply, or perfect appropriation, of pabulum, induces the cells to construct abnormal tissue or deformed organs—to produce abnormality or deformity in parts of a system—therefore, due supply, exact distribution, and perfect appropriation of nutritive plasma constitutes the domain of science which is known as physiology. Any deviation from the normal process is called a *pathological* manifestation. Such manifestation implies disease, and all that department of science which relates to the cause or causes of diseased action is known as *Etiology*.

The etiological department of scientific investigation has not become exact enough for the clear detection of all that which interferes with nutrition and excites diseased action, yet reference may be made to effects which seem to be, directly or indirectly, the sequence of certain causes. From the time of the segmentation of the blastoderm (segmenting body—protoplasm,) of the fecundated ovum, on through embryonal existence, infancy, childhood, youth and manhood, to old age, remote and proximate causes of

disease may manifest themselves, and death ensue. There are many remote causes of disease, and they may be connected with almost every element of the system.

The demand of the system of the *enciente* for the phosphates and the other necessary elements is not always fully supplied, or the mother's system may not have been in the proper condition, during the embryonic and infantile existence of the child, to assimilate the nutritious particles, even were they furnished in full proportion, and this may lead to a manifestation of disease which would not otherwise have been developed. From the time the fœtal system enters upon its individual existence, to the time when inhalation, and systemic, organic, tissual, cellular, granular, and molecular life ceases—to the time when what we call *death* ensues, and the soul takes its flight—there is danger of disease and death from infraction of the nutrient law. The inhalation of air charged with parasites and particles of disintegrating animal and vegetable tissue, the drinking of water containing such matter, and such of the lower forms of life as act injuriously upon the system, and the taking of improper, or imperfectly, or too *thoroughly* prepared food, all these may act as factors in the production of disease.

As disturbance of function during the development of the child *in utero* may lead to, and is very often manifested in, imperfect organic development, so, also, are the factors of function—the cells—so interfered with through systemic disease during infancy and childhood that the building up of tissue is retarded, and when the organ is developed there may be seen a line between the unarrested and arrested tissual development. Such is often clearly seen in enamel where arrested nutrition, and consequently arrested development, is recorded in distinct and indelible characters. The etiology of this abnormal development of enamel tissue is traceable to an arrest of nutrient activity at the time when the cusps of the first permanent molar and incisor teeth, and sometimes when the bicuspid and cuspid teeth, are being formed. The diseases which cause such suspension of nutrient action are the exanthemata, scarlatina, measles, and even less marked systemic disease; these lead to a disturbance of the activity in and supply of pabulum to the cells, and thus imperfect tissual and organic development may follow. Imperfect development of tissues and organs may take place and not be made manifest during the development of the system, nor subsequently, unless diseased action ensues. Then the imperfect structure may be attacked and may thus lead to the injury or death of the entire body. Abnormal tissues and rudimentary organs may also lie dormant throughout life and not be known

of or suspected. For instance, more or less imperfectly developed dental tissues encased in what is known as "dentigerous cysts," and the rudimentary organ, *appendix vermiformis*, may remain inactive—encysted or suspended—during the whole of life, yet the one has been transformed from a benign and led to a malignant tumor, and had to be removed, while the other has become diseased through an accumulation of seeds, calculus, and other matter within it, and soon led to the death of the patient.

Out of the protoplasm of the fecundated ovum, and through lack of quantity and quality and proper appropriation of the pabulum furnished to the cells, while the system is developing and has been developed, imperfect tissues and organs appear, changing the form, not only of the system, but of the organs themselves. Even enamel tissue may not only have been imperfectly developed, but the form of the whole organ, particularly the crown of the tooth, may have been modified. Just at the time when the enamel is not fully calcified and fixed in form, the system may be seized by a spasm, and through this the coronal part of the organ may be so changed as to appear as one of those known as the "Hutchinson Teeth." Dr. C. N. Peirce, of Philadelphia, cited an instance of this in an essay upon "The Development of the Teeth as recognized by the Authorities of To-day," read at the meeting of the Pennsylvania State Dental Society in July of this year. It would be well, therefore, for all diagnosticians to consider this before attributing the cause of such mal-formed organs to syphilitic taint. In addition to the similarity of form between the teeth developed under the influence of the syphilitic or other forms of spasmodic disease, Dr. Peirce remarked that when such teeth as he referred to are erupted, there are sometimes notches upon the cutting edge which are afterwards broken or worn off, thus indicating that there must have also been other systemic disease at the time the enamel was in its first stages of calcification. He advised all to consider this matter carefully, and not to refer the cause of such modified organic form to syphilitic influence, when it may possibly be traced to another disease.

Throughout the animal and vegetable kingdoms each and every form of life conforms to what is known as a type. There may, however, be minor modifications of type. Retrograde metamorphosis may also take place, and this has been noticed at times, especially in the human species. Disease, or imperfect or arrested development because of disease, may not only lead to such metamorphosis, but all this may be transmitted to the issues from a species through hereditary influences. The typal presence resident within the impregnated ovum may so manifest itself as to show the outline, in almost

every particular, of the parent type; the features may have nearly the same appearance, the tissues present the same fullness or character of outline, and the organs a similar regular and irregular arrangement. This is often markedly the case with dental tissues. The proximate causes of disease consist in the modification of the presentment of the modes of life.

Dr. W. H. Atkinson in a paper upon "Necrosis and Caries," published in the February number of the *Dental Cosmos* for 1876, states that "Health depends upon the free circulation of pabulum in the various tissues of the body," and upon its proper "appropriation by the diastole and systole of the cell-territories." "Nutrition—nourishment—consists in a harmonious concurrence of supply and departure, a coming and going of mass and energy." If this process "be rythmical and regular, we have *health.* If the afflux exceed the efflux," or *vice versa*, then we have "*hypertrophy* or *atrophy*, and these are the only doors of entrance for disturbance of tensional harmony in the currents of nutrition—which is *disease.*" Extremes of heat and cold, therefore, which accelerate or retard functional activity—interfere with the neural and vascular circulation—may thus act as a proximate or direct cause of disease, may be that which immediately precedes or produces an effect. This effect may be a want of *ease* in the part or parts, and it is, therefore, a *disease.* This condition may be followed by a still more marked manifestation of disease, and especially if a remote cause asserts itself.

In the enamel, which has about ninety-eight per cent. of mineral constituents, extremes of heat and cold may have no other immediate effect than to produce minute fractures, although capillary and endosmotic and osmotic action is also interfered with. When some remote cause favors it, and some such proximate cause interferes with the due supply and perfect appropriation of nutritive plasma, necrosis may follow; in a word, and in the language of Dr. Atkinson, "*Necrosis results from privation of pabulum.*" Dr. Atkinson further states that "All forms of death of the structures of the body are examples of true necrosis. Hence the analogue of *ulcer* in the soft parts is *caries* in the hard; that of *abscess* in the soft parts is *necrosis* in the bones." "Each change of place of pabulum involves the mechanical, chemical, and dynamical concomitant changes, the due equation of which constitutes health, and the deficiency of either, disease."

The proximate cause of disintegration of enamel and dentine seems to be due, almost, if not entirely, to acids, both mineral and vegetable; at least through chemical action both these tissues, the enamel and dentine,

may eventually be destroyed if the disintegration of enamel be not checked, and carious dentine be removed, and the cavity in which such action took place be closed.

If, says Prof. Kuss, "we examine the *acts* of which the living being is the theatre, we meet with a great number of physical and chemical phenomena resembling in every respect those produced in inanimate nature." This being the view of an acknowledged expert, we feel justified in saying that in the mineral inorganic kingdom we notice that when a depolarization of currents occurs, there is a marked manifestation of electrity. This mysterious force may, under certain circumstances, rend portions of matter asunder, and again seem to be the power which has most to do with the regular arrangement of crystals in the mineral, and perhaps cells in the vegetable, and globules in the animal kingdom.

The constituent elements of the globules or cells which build up animal tissue, are water, albumen, and fat, and mineral substances, "Such as potassium (in a state of potash salts,) and phosphates; these two substances are especially found in the nerve elements; also sulphur incorporated with albumen or represented by its salts. The same may be said of sodium, calcium, iron, magnesium, and even some other metals." It seems quite evident that it is to the multiplicity of these elements that the globules or cells owe their electro-motor power. Prof. Kuss remarks that "this property of disengaging electricity is especially met with in the nerves or nerve tubes, which are not globules but derive their properties from and are in intimate association with these globules." Thus we may see that there are phenomena which cannot well be explained, either by chemistry or physics, yet as chemistry advances to a more perfect state, and biology —"the different phases of life,"—is better understood, then may physiology be found to be the highest and most perfect manifestation of organic chemistry. Then, too, may we be the better prepared to search out and comprehend the remote as well as the proximate causes of disease and death, which causes can only be fully ascertained when pathology becomes an exact department of science.

In relation to this last reference, as to several other references to physiology, biology, chemistry, pathology and etiology, I will only further say, in the language of Prof. Tyndal, that "Here, however, I touch a theme too great for me to handle, but which will assuredly be handled by the loftiest minds when you and I, like streaks of morning cloud, shall have melted into the infinite azure of the past."

REPORT OF THE COMMITTEE

ON

INSTRUMENTS AND APPLIANCES.

The committee on appliances in submitting their report take pleasure in stating that the past year has been scarcely less productive of new and improved instruments and materials than any that has preceded it, and although nothing especially noteworthy to the degree of the Burring Engine or the Rubber Dam has been brought forward, yet it is evident that the mental activity which has characterized the period, in the domain of Physiology, Pathology, and Therapeutics has been equaled and supplemented by the inventive talent of our profession, and we are sure that not a little has been done by these means towards rendering our work less exhaustive, both to ourselves and our patients, as well as greatly enhancing the permanence and value of the operations themselves.

Like our predecessors of last year, we have to complain that the suggestion made to inventors that they should send their productions to the committee in advance of the meeting of this body that they might be more carefully examined and described, has not been acted upon, and consequently the Association must take up and be satisfied with a very hasty and imperfect description of the appliances brought to our notice.

Among the more striking articles shown is a new Operating Chair, the invention of Dr. B. M. Wilkerson, of Baltimore. It is quite unique in its construction, and attractive in appearance. Not proposing to go into a detailed description of this chair, we would note a few of its distinctive features. All the movements of the body and footstool are made very easily by the foot of the operator, not requiring the use of the hands. The movements are, moreover, made with little noise or jarring, and with great rapidity. A very desirable feature is an adjustable back, which forms, when required, a very perfect child's chair. This feature strikes us as most excellent. On the whole we desire to commend the invention, and congratulate the profession that such an excellent addition has been made to the many elegant and convenient chairs already in use.

While speaking of these articles we cannot fail to notice very favorably the S. S. White chair, which has been improved in some particulars during the past year, and made thereby still more worthy of the favorable notice which it then received.

In this connection we may mention Lyon's Operating Stool, which now is shown with an improved lock-brake, permitting the standard to be more readily and securely adjusted to the position of the operator. A spring bolt has been substituted for the set screw, and the edge of the top better padded for the protection of the thighs. This reminds us to suggest to the manufacturers of dental chairs, as well as stools, that the comfort and usefulness of such articles would be increased by a more generous style of upholstery. Nearly all the chairs and head-rests, as now made, are "too bony."

The Electro-Magnetic Mallet of Dr. W. G. A. Bonwill (to whom is due much of the credit of having introduced and perfected this instrument,) is shown us, having been modified and improved in several particulars since the last report. It has now been reduced to the smallest number of working parts, and the pieces are in the simplest form, so that any one can duplicate them if necessary. The whole has been so consolidated as to take up the least space in the hand, and so balanced as to rest pleasantly and securely therein. The blow, or impact, has been increased fully one-half, without increasing the size of the magnets or changing their simplicity. A still further improvement permits the use of plugger-points with either long or short handles. These and some minor changes have in the opinion of the inventor brought this valuable instrument nearly to perfection, and should secure for Dr. Bonwill the well-merited honors to which he is fairly entitled.

A new method of mounting teeth, or rather, a new style of plate-work, was shown by Dr. Geo. F. Reese, of Brooklyn. The plate is cast very much in the manner of Cheoplastic work, but an ingenious flask is used, which simplifies the work very considerably. The material of the plate is an alloy of tin, seeming to possess great strength, and of good color, which, it is claimed, is retained during wear. We see no reason to suppose that such plates would be in any respect inimical to health, and think that the style of work may, in many cases, prove very desirable.

An Automatic Engine-Mallet, the invention of Dr. G. W. LeVin, of Chicago, was shown by Dr. Swain, adjustable to any angle, from direct front, to direct back action, and in size easy to handle. It has been used successfully by several practitioners, and seems well adapted for its work.

S. S. White exhibits:

A Brake for the immediate stopping of the Burring Engine, and an improved Collar-lock for the hand piece.

Some gutta-percha in pellets, which are very convenient for use, and improved in quality, being tougher and less sticky than those formerly supplied.

Weston's Platinum Cavity-caps, for carrying plastic coverings for exposed pulps. The edges are turned, and a hole in the center serves for the escape of surplus material, and offers a convenient means of handling.

A Folding Engine-tool-rack, the invention of Dr. W. A. Stevens, is a very ingenious affair, admirably adapted to the purpose.

A closed Spittoon-Bracket, invented by L. T. Foss, which opens to receive the spittoon, then locking around it, thus rendering accidental displacement of the spittoon impossible. There is also a stop-pin by which the horizontal swinging may be prevented. This seemed to be a most perfect appliance.

A Gas-Cylinder with improved plug-valve. Also a mouth-piece with improved valve, in which the simple turning of a handle admits air to the patient, or the reverse admits gas, and also shuts off the gas more completely than the old style; they are both attached to a very neat apparatus for gas.

One of the most useful articles shown by S. S. White is Dr. Farrar's Alveolar Abscess Syringe. This can be used either as an ordinary, or a drop

syringe, and is supplied with several forms of nozzle, by the use of which the treatment of abscesses is rendered much more satisfactory and successful than by the means ordinarily employed.

Johnston Brothers brought to our notice, in addition to the Wilkerson Chair, several lesser improvements, among which were a device in the Elliott Suspension Engine for keeping the driving wheel off center when at rest, and at the same time making the motion of the treadle easier. A very desirable change has also been made in the hand-piece, whereby the wear consequent upon use is compensated for in such a way as to secure entire steadiness of motion to the tool. They also show a new valve for confining liquid gas, constructed on a principle which would seem to overcome the difficulty which has heretofore attended the use of gas confined under great pressure, namely, that of rusting and consequent wear.

A very complete set of Clamps, to facilitate the use of the Rubber Dam, devised by Dr. Delos Palmer, of New York, was also shown. These have been carefully elaborated, and the set consists of quite a number, each one perfectly adapted to its typical tooth, and arranged in a case so as to be convenient for use.

Dr. W. S. Elliott's Articulator has also been slightly improved, so that the model can now be attached instantly without the use of plaster.

Dr. W. N. Morrison's instruments for making and using retaining screws are also improved.

A little Saw-and File-Carrier, the invention of Dr. Clapp, will be found very useful.

In *materials for filling teeth* not much that is new or improved has been seen. Allusion has already been made to White's improved form and quality of gutta-percha. He also showed us cylinders of combined gold and platinum, gold and tin, and platinum and tin. What the advantage of such combinations may be, we do not profess to know, nor do we deny that they may be considerable; experiment alone can determine.

R. S. Williams has given as a new preparation of gold foil, containing a slight alloy of tin or cadmium, giving to the foil extreme softness. We have reason to think the article will be much liked. A very convenient

foil tray and case, devised by Dr. Gaylord, is made by Mr. Williams. A glass cover keeps out dust and permits a view of the contents of the case.

Standard Tin Foil also shown by Mr. Williams is said to be prepared somewhat differently from the usual way, and seemed to be very tough and pliable.

Dr. E. R. Mullett, of Clinton, Iowa, offers an Automatic Mallet, which possesses the advantage of being lighter than ordinary, and very compact.

A "*Stop-Motion Hand-Piece*," exhibited by Dr. E. Osmond, of Cincinnati, is adaptable to any style of engine, and seems to be entirely new in principle and application. The revolution of the burr is immediately stopped by the index finger, while the engine continues running.

A "*Parallel-Motion Bracket*," exhibited by the Buffalo Manufacturing Co., is adjustable at any point within its range, and held in position by friction, without change of screws or stops.

Dr. S. A. Watling exhibited an improved Lower Molar Forceps, by which he claimed the force in extracting is exerted by the shoulder instead of the wrist, at the same time giving the operator a more perfect view of the tooth upon which he is operating.

Dr. S. Babcock, of Springfield, Illinois, exhibited a "Diamond Disk," composed of diamond dust imbedded in copper, as a substitute for the ordinary corundum-wheel; also, platinum strips charged with diamond dust for finishing proximal fillings. Both seem well adapted for their work.

Dr. J. W. Greene, of Chillicothe, Missouri, showed a simple and effectual device in the nature of a double cylinder, whereby a common chair can be readily converted into an operating chair. He also presents *Mills' Turbine Motor*, small and compact for running the Dental Engine. It is made in larger sizes, suitable for the lathe and heavier work.

Tuerk's Hydraulic Dental Burring Engine strikes us as being of great merit, inasmuch as it is simple, powerful, economical in the use of water, and so small and light as to be handled with great facility. Its movement is easily controlled, and the speed can be increased or diminished at will.

Desiring to bespeak the indulgent criticism of this Association, as well as that of the parties mentioned in the above, for the necessarily incomplete manner in which we have performed our task, this report is respectfully submitted.

ALBERT H. BROCKWAY,
THOMAS FILLEBROWN, } Committee.

REPORT OF THE COMMITTEE

ON

PRIZE ESSAYS.

Your committee would report that they have had given them for investigation, one essay, which they have carefully read. They are of the opinion that this essay does not come within the scope of the intention of the Association in establishing prizes. The Constitution (Art. VI. Sec. 5.) reads: "Two prizes of medals, not exceeding in value fifty dollars each, may be awarded to the best two communications reported on favorably by the Committee on Prize Essays, directed by the Association to be published." This is all the directions the committee have to guide them. They are of the opinion that the essay in question is not of sufficient general interest to the profession at large to authorize the Association to grant its author a medal, or to go to the expense of publishing it. They would therefore recommend that it be returned to the author.

W. H MORGAN, }
L. D. SHEPARD, } Committee.

TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

EIGHTEENTH ANNUAL SESSION,

HELD AT NIAGARA FALLS,

COMMENCING ON THE 6TH OF AUGUST, 1878.

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LIST OF OFFICERS FROM DATE OF ORGANIZATION.

PRELIMINARY CONVENTION, NIAGARA FALLS, AUGUST, 1859.

President,	W. W. ALLPORT, - -	Chicago.
Secretary,	J. TAFT, - - - -	Cincinnati.

ORGANIZATION AND FIRST SESSION OF ASSOCIATION, WASHINGTON, D. C., JULY, 1860.

[Annual meetings to be hereafter last Tuesday in July.]

President,	W. H. ATKINSON, - -	Cleveland.
1st Vice-President,	J. B. GIBBS, - - -	Washington, D. C.
2d Vice-President,	W. CAHOON, - - -	Detroit, Mich.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	W. MUIR ROGERS, -	Shelbyville, Ky.
Treasurer,	S. DILLINGHAM, - -	Philadelphia.

[NO MEETING IN 1861.]

CLEVELAND, JULY, 1862.

President,	GEO. WATT, - - -	Xenia, Ohio.
1st Vice-President,	W. H. ALLEN, - - -	New York City.
2d Vice-President,	W. D. STONE, - -	Lexington Ky.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	J. F. JOHNSTON, - -	Indianapolis.
Treasurer,	W. A. PEASE, - - -	Dayton, Ohio.

PHILADELPHIA, JULY, 1863.

President,	W. H. ALLEN, - -	New York City.
1st Vice-President,	J. H. MCQUILLEN, - -	Philadelphia.
2d Vice-President,	WM. B HURD, - -	Brooklyn, N. Y.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	C. R. BUTLER, - -	Cleveland.
Treasurer,	A. C. HAWES, - - -	New York City.

NIAGARA FALLS, JULY, 1864.

President,	J. H. MCQUILLEN, -	Philadelphia.
1st Vice-President,	C. P. FITCH, - - -	New York City.
2d Vice-President,	H. BENEDICT, - -	Detroit.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	GEO. W. ELLIS, - -	Philadelphia.
Treasurer,	I. J. WETHERBEE, - -	Boston.

CHICAGO, JULY, 1865.

President,	C. W. SPALDING, - -	St. Louis.
1st Vice-President,	GEO. H. CUSHING, - -	Chicago.
2d Vice-President,	JAS. MCMANUS, - -	Hartford.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	L. D. SHEPARD, - -	Boston.
Treasurer,	I. J. WETHERBEE, - -	Boston.

BOSTON, JULY, 1866.

President,	C. P. FITCH, - - -	New York City.
1st Vice-President,	W. H. MORGAN, - -	Nashville.
2d Vice-President,	L. D. SHEPARD, - -	Boston.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	A. HILL, - - -	Norwalk, Conn.
Treasurer,	W. W. SHEFFIELD, - -	New London, Conn.

CINCINNATI, JULY, 1867.

President,	A. LAWRENCE, - -	Lowell, Mass.
1st Vice-President,	P. G. C. HUNT, - - -	Indianapolis, Ind.
2d Vice-President,	A. S. TALBERT, - -	Lexington, Ky.
Recording Secretary,	J. TAFT, - - - -	Cincinnati.
Corresponding Secretary,	C. R. BUTLER, - -	Cleveland.
Treasurer,	W. H. GODDARD, - -	Louisville, Ky.

NIAGARA FALLS, JULY, 1868.

President,	JONATHAN TAFT, - -	Cincinnati.
1st Vice-President,	HOMER JUDD, - - -	St. Louis.
2d Vice-President,	A. A. BLOUNT, - -	Springfield, Ohio.
Recording Secretary,	EDGAR PARK, - - -	St. Louis.
Corresponding Secretary,	JAS. MCMANUS, - -	Hartford.
Treasurer,	W. H. GODDARD, - -	Louisville.

SARATOGA SPRINGS, AUGUST, 1869.*

President,	HOMER JUDD, - -	St. Louis.
1st Vice-President,	S. J. COBB, - - -	Nashville.
2d Vice-President,	C. E. FRANCIS, - -	New York City.
Recording Secretary,	M. S. DEAN, - - -	Chicago.
Corresponding Secretary,	I. A. SALMON, - -	Boston.
Treasurer,	W. H. GODDARD, - -	Louisville.

* Owing to a change in the Constitution. officers elected at this and the sessions following served at the next annual meeting subsequent to their election ; and the sessions on and after 1869 commenced on the first Tuesday in August.

NASHVILLE, AUGUST, 1870.

President,	W. H. MORGAN,	Nashville.
1st Vice-President,	S. W. DENNIS,	San Francisco.
2d Vice-President,	J. R. WALKER,	New Orleans.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	I. A. SALMON,	Boston.
Treasurer,	W. H. GODDARD,	Louisville.

WHITE SULPHUR SPRINGS, VA., AUGUST, 1871.

President,	GEO. H. CUSHING,	Chicago.
1st Vice-President,	C. E. FRANCIS,	New York City.
2d Vice-President,	J. R. WALKER,	New Orleans.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	I. A. SALMON,	Boston.
Treasurer,	W. H. GODDARD,	Louisville.

NIAGARA FALLS, AUGUST, 1872.

President,	P. G. C. HUNT,	Indianapolis.
1st Vice-President,	L. D. SHEPARD,	Boston.
2d Vice-President,	G. A. MILLS,	Brooklyn, N. Y.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	J. TAFT,	Cincinnati.
Treasurer,	W. H. GODDARD,	Louisville.

PUT-IN-BAY, AUGUST, 1873.

President,	T. L. BUCKINGHAM,	Philadelphia.
1st Vice-President,	ISAIAH FORBES,	St. Louis.
2d Vice-President,	A. F. MCLAIN,	New Orleans.
Recording Secretary,	M. S. DEAN,	Chicago.
Corresponding Secretary,	J. TAFT,	Cincinnati.
Treasurer,	W. H. GODDARD,	Louisville.

DETROIT, AUGUST, 1874.

President,	M. S. DEAN,	Chicago.
1st Vice-President,	GEO. W. KEELY,	Oxford, Ohio.
2d Vice-President,	J. S. KNAPP,	New Orleans.
Recording Secretary,	C. STODDARD SMITH,	Springfield, Ill.
Corresponding Secretary,	GEO. L. FIELD,	Detroit.
Treasurer,	W. H. GODDARD,	Louisville.

NIAGARA FALLS, AUGUST, 1875.

President,	A. L. NORTHROP, - -	New York City.
1st Vice-President,	H. J. MCKELLOPS, - -	St. Louis.
2d Vice-President,	H. A. SMITH, - -	Cincinnati.
Recording Secretary,	C. STODDARD SMITH, -	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN, -	Philadelphia.
Treasurer,	W. H. GODDARD, - -	Louisville.

PHILADELPHIA, AUGUST, 1876.

President,	GEO. W. KEELY, - -	Oxford, Ohio.
1st Vice-President,	C. N. PEIRCE, - - -	Philadelphia.
2d Vice-President,	CORYDON PALMER, -	New York City.
Recording Secretary,	C. STODDARD SMITH, -	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN, -	Philadelphia.
Treasurer,	W. H. GODDARD, - -	Louisville.

CHICAGO, AUGUST, 1877.

President,	F. H. REHWINKEL, -	Chillicothe, Ohio.
1st Vice-President,	L. D. SHEPARD, - -	Boston.
2d Vice-President,	GEO. T. BARKER, - -	Philadelphia.
Recording Secretary,	M. S. DEAN, - - -	Chicago.
Corresponding Secretary,	M. H. WEBB, - -	Lancaster, Pa.
Treasurer,	W. H. GODDARD, - -	Louisville.

NIAGARA FALLS, AUGUST, 1878.

President,	H. J. MCKELLOPS, - -	St. Louis.
1st Vice-President,	L. D. SHEPARD, - -	Boston.
2d Vice-President,	L. D. CARPENTER, -	Atlanta, Ga.
Recording Secretary,	GEO. H. CUSHING, - -	Chicago.
Corresponding Secretary,	A. O. RAWLS, - -	Lexington, Ky.
Treasurer,	W. H. GODDARD, - -	Louisville.

EXECUTIVE COMMITTEE, 1878–9.

J. N. CROUSE, Chairman, THOS. FILLEBROWN, Secretary.

FIRST DIVISION — COMMITTEE OF ARRANGEMENTS.

FILLEBROWN, CUSHING, AND JUDD.

SECOND DIVISION — ON CREDENTIALS AND AUDITING COMMITTEE.

CROUSE, KEELY AND NORTHROP.

THIRD DIVISION — ON NOMINATIONS AND VOLUNTEER ESSAYS.

MORGAN, BLACK AND PEIRCE.

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION

SESSION OF 1878.

By M. S. DEAN, Secretary.

FIRST DAY—MORNING SESSION.

THE American Dental Association commenced its Eighteenth Annual Session at Grant Hall, Niagara, Tuesday, August 6, 1878, at 10 a.m.; the President, F. H. Rehwinkel, in the chair.

The exercises were opened with prayer by Dr. Morgan.

The roll of qualified members was then called, and the following members answered to their names:*

Allen, W. H.	18 West Eleventh st., New York.
Allen, John	314 Fifth ave., New York.
Atkinson, W. H.	41 East Ninth st., New York.
Abbott, Frank	12 West Nineteenth st., New York.
Ambler, J. G.	25 West Twenty-third st., New York.
* Biddle, C. H.	50 Livingston st., Brooklyn, N. Y.
Buckingham, T. L.	1206 Vine st., Philadelphia.
Black, G. V.	Jacksonville, Ill.
Beck, C. S.	Wilkesbarre, Penn.
Beach, H. E.	Clarksville, Tenn.
Brown, Sen. B.	Fort Wayne, Ind.
Barrett, W. C.	Warren, N. Y.
* Bronson, W. A.	8 East Thirty-fourth st., New York.
Brophy, T. W.	126 State st., Chicago.
Brackett, C. A.	Newport, R. I.

* Those marked with a star were not present, but forwarded their dues.

*Colton, A.	Hudson, N. Y.
*Chaim, M. L.	30 Cooper's Institute, New York.
Crouse, J. N.	734 Michigan ave., Chicago.
Cushing, Geo. H.	174 State st., Chicago.
Cummings, S. M.	Elkhart, Ind.
Cassidy, J. S.	Covington, Ky.
Cleland, Jas.	Detroit, Mich.
Carpenter, L. D.	Atlanta, Ga.
Cook, C. D.	133 Pacific st., Brooklyn, N. Y.
Clancy, D. W.	Cincinnati, Ohio.
Carman, G. W.	Englewood, N. J.
Dennis, S. W.	33 Kearney st., San Francisco, Cal.
Dean, M. S.	174 State st., Chicago.
Darby, E. T.	1513 Walnut st., Philadelphia.
Douglass, I.	Romeo, Mich.
Eames, W. H.	1224 Washington ave., St. Louis.
Emminger, A. F.	Columbus, Ohio.
Freeman, S. A.	Buffalo, N. Y.
Fillebrown, Thos.	Portland, Maine.
Field, Geo. L.	Detroit, Mich.
Fuller, A. H.	1225 Washington ave., St. Louis.
Flagg, J. F.	Philadelphia.
Friedrichs, Geo. J.	155 St. Charles st., New Orleans.
Farrar, J. N.	94 Green ave., Brooklyn, N. Y.
Forbes, Isaiah	Eighth st., St. Louis.
Goddard, Wm. H.	Louisville, Ky.
Gorgas, F. J. S.	Baltimore, Md.
*Gaylord, E. S.	New Haven, Conn.
How, W. S.	Cincinnati, Ohio.
Hooper, J.	Owenton, Ky.
Harlan, A. W.	70 Dearborn st., Chicago.
Hunt, R. Finley	1806 H st., Washington, D. C.
Hall, J. W.	1337 Washington ave., St. Louis.
Hill, J. L.	Gettysburg, Pa.
Harper, J. G.	1605 Washington ave., St. Louis.
Hoag, Wm. E.	135 Lexington ave., New York.
*Hunter, E.	Jackson, Mich.
*Holmes, E. S.	Grand Rapids, Mich.
*Hurtt, J. M.	Peoria, Ill.
Ingersoll, L. C.	Keokuk, Iowa.
Jarvie, Wm., Jr.	Brooklyn, N. Y.
Jackson, H. H.	319 Jeff. ave., Detroit, Mich.
Keely, Geo. W.	Oxford, Ohio.
Klump, G. W.	Williamsport, Penn.
King, Coulter	Pittsburgh, Pa.
*Kingsbury, A. C.	Philadelphia.

LATHROP, J.	152 Woodward ave., Detroit, Mich.
*MCMILLAN, J. T.	Paris, Ky.
MORGAN, W. H.	Nashville, Tenn.
MCMANUS, JAS.	Hartford, Conn.
MCKELLOPS, H. J.	615 Olive st., St. Louis.
MCQUILLEN, J. H.	1713 Arch st., Philadelphia.
MCDONALD, G. B.	Conneautville, Penn.
*MARRINER, J. F.	Ottawa, Ill.
*NOYES, EDMUND	103 State st., Chicago.
*NOBLE, H. B.	1111 Penn. ave., Washington, D. C.
*OSMOND, E.	266 Vine st., Cincinnati, Ohio.
ODELL, F. M.	18 West Eleventh st., New York.
PEIRCE, C. N.	1617 Green st., Philadelphia.
PRIEST, A. N.	Utica, N. Y.
PALMER, S. B.	Syracuse, N. Y.
PALMER, EDGAR	La Crosse, Wis.
PAGE, W. E.	142 Main st., Charlestown, Mass.
RICHARDS, F. J.	Williamsport, Pa.
RIGGS, W. E.	Lawrence, Mass.
REHWINKEL, F. H.	Chillicothe, Ohio.
RAWLS, A. O.	Lexington, Ky.
RHONE, J. W.	Bellefonte, Penn.
REYNOLDS, W. M.	62 West Fourteenth st., New York.
*SAGE, H. L.	Bridgeport, Conn.
SHEPARD, L. D.	100 Boylston st., Boston.
*SWARTLEY, J. S.	749 Michigan ave., Chicago.
SPALDING, C. W.	1606 Olive st., St. Louis.
SMITH, A. WILKES	Richmond, Ky.
SMITH, H. A.	286 Race st., Cincinnati, Ohio.
SMITH, D. D.	1417 Walnut st., Philadelphia.
STOCKTON, C. S.	Newark, N. J.
STIPP, J. A.	Sidney, Ohio.
TAFT, J.	117 West Fourth st., Cincinnati, Ohio.
TEMPLETON, J. G.	299 Penn. ave., Pittsburgh, Pa.
TAYLOR, JAS.	Elm st., Cincinnati, Ohio.
TAFT, WILL	194 West Fourth st., Cincinnati, Ohio.
WATERS, GEO. F.	8 Beacon st., Boston.
WEBB, M. H.	Lancaster, Pa.
WETHERBEE, I. J.	46 Dover st., Boston.
WELCH, CHAS	Wilmington, Ohio.
WATLING, J. A.	Ypsilanti, Mich.
WERNER, J. G. W.	548 Tremont st., Boston.
*WHEELER, C. F.	Albany, N. Y.
WELLS, MERRITT	Indianapolis, Ind.
WHITAKER, GEO. W. H.	Sandersville, Ga.
WAY, S. J.	Waynesville, Warren county, Ohio.
WHINERY, J. C.	Salem, Ohio.

The reading of the minutes of the last annual session was commenced, when the motion that the further reading be omitted, with the exception of those of the final session, was carried.

The minutes were amended so as to include the report of Dr. Hawxhurst, in the sentence on page 27, which says, "the latter was adopted and indorsed."

On motion of Dr. McQuillen, the minutes were further corrected by inserting the following resolution, which had been omitted:

Resolved, That the Corresponding Secretary be instructed to have a certificate of membership of the American Dental Association engraved for the honorary members, and other members who may desire to have it.

And, on motion, the preparation of the design and carrying into effect this resolution were intrusted to Drs. Webb and McQuillen.

On motion of Dr. Shepard they were further amended to show more definitely that the report read by him at the last annual session, on Dental Literature, was written by Dr. W. A. Bronson, a member of that committee.

The minutes of the final session of last year, as amended, were then approved.

Dr. Fillebrown presented a programme of the order of business for the present session, which was accepted and adopted.

The Executive Committee reported the appointment of Dr. G. V. Black to fill the vacancy caused by the absence of Dr. Northrop in the Committee on Appliances, and Dr. C. N. Pierce on the Committee on Nominations, vacated by Dr. Judd.

The Committee on Credentials made a partial report, which, by subsequent reports, was completed, as follows:

Brooklyn Dental Society — W. H. Atkinson, J. N. Farrar.
Chicago Dental Society — A. W. Harlan, G. H. Cushing, T. W. Brophy.
Connecticut Valley Dental Society — J. McManus.
First District Dental Society of the State of New York — W. E. Hoag, Wm. M. Reynolds.
Georgia State Dental Society — L. D. Carpenter, G. W. H. Whitaker.
Illinois State Dental Society — G. V. Black, M. S. Dean, J. N. Crouse.
Indiana State Dental Association — S. B. Brown.
Iowa State Dental Association — L. C. Ingersoll.

Kentucky Dental Association—W. H. Goddard, J. Hooper, A. W. Smith, A. O. Rawls, J. S. Cassidy.
Lake Erie Dental Association—G. B. McDonald.
Maine Dental Society—T. Fillebrown.
Massachusetts Dental Society—J. G. W. Werner, W. E. Page.
Merrimack Valley Dental Society—W. E. Riggs.
Michigan Dental Society—J. Douglass, James Cleland.
Mississippi Valley Association of Dental Surgeons—W. S. How, S. M. Cummings, Chas. Welch, J. A. Stipp, A. F. Emminger, S. J. Way.
Missouri State Dental Association—A. H. Fuller, J. W. Hall.
New York Odontological Society—Wm. Jarvie, jr.
New Jersey State Dental Society—G. W. Carman.
Ohio Dental College Association—James Taylor.
Ohio State Dental Society—J. W. Lydie.
Pennsylvania Association of Dental Surgeons—C. N. Peirce.
Pennsylvania State Dental Society—E. T. Darby.
Pittsburgh Dental Society—J. G. Templeton, C. King.
Tennessee Dental Association—H. E. Beach.
The Dental Society of the State of New York—A. N. Priest.
St. Louis Dental Society—J. G. Harper.
Susquehanna Dental Association—J. W. Rhone.
Boston Dental College—I. J. Wetherbee.
Dental College of the University of Michigan—J. A. Watling.
Dental School of Harvard University—L. D. Shepard.
Missouri Dental College—W. H. Eames.
Pennsylvania College of Dental Surgery—T. L. Buckingham.
Philadelphia Dental College—D. D. Smith.
Western College of Dental Surgeons—C. W. Spalding.

Respectfully submitted. L. D. SHEPARD, J. N. CROUSE, M. H. WEBB, } *Committee on Credentials.*

A letter was read from Dr. J. J. Birge, tendering his resignation to the A. D. A., which was accepted.

The Corresponding Secretary made the following report, which was accepted and laid on the table for further consideration:

Your Corresponding Secretary would respectfully report that he has attended to the duties assigned him, notified the gentlemen who were elected Honorary Members of the Association, viz: John Tomes, M.R.C.S.; Chas. S. Tomes, M.A., M.R.C.S.; J. Smith Turner, M.R.C.S.; George Von Langsdorff, D.D.S.; E. Magitot, M.D.; Adolf Petermann, D.D.S.; Mordaunt Stevens, M.D., D.D.S., M.R.C.S., and Dr. Fr. Wedl. A reply has been received from each of the gentlemen named excepting John Tomes.

In compliance with the resolution passed at the last meeting of this

Association, your Corresponding Secretary, in connection with Dr. McQuillen, has seen to the getting up of a certificate of membership, a copy of which is here presented. MARSHALL H. WEBB,

Corresponding Secretary.

Upon motion of Dr. Cushing, the amendments to the constitution were now taken up.

The amendment offered by Dr. Taft was then read, as follows: Change Art. III, Sec. 4, so as to read—"All delegates shall be practitioners of dentistry; they shall receive their appointment from permanently organized *state* dental societies and dental colleges."

Dr. Dean moved its adoption.

Dr. Crouse moved, as a substitute, that the question be indefinitely postponed. Carried.

The amendment offered by Dr. Keely to change Art. III, Sec. 1, so as to read: "Each local society may send one delegate for every fifteen of its active members," was then read.

Dr. Taft moved to amend by limiting the number to ten members.

The substitute and the motion to adopt the amendment were lost.

On motion of Dr. Cushing, the reports of special committees were called for. Whereupon Dr. Hunt, chairman of the committee of ten on the formation of sections, made the following report:

REPORT OF COMMITTEE ON SECTIONS.

To the American Dental Association:

The action of the American Dental Association in adopting the following resolution has been interpreted by the enlarged committee as a desire that the subject should be more maturely considered and the results of that consideration laid before the Association in a more exhaustive report and a more detailed and perfected plan:

"*Resolved*, That the committee be increased to ten members, and that the report presented by the committee of three be recommitted to said comtee for amendment or reconsideration, and that they be instructed to print the results of their deliberations, and that a copy be mailed to each member of the Association at least one month before the next annual meeting."

Acting upon this interpretation, the committee will endeavor to set forth the advantages and objections attending the introduction of this very material change in the working machinery of the Association. On both these points it will be necessary to compare the probable working and results of the proposed system of permanent sections with the known and tried ones of the present plan of annual committees. The committee cannot do better in that direction than to quote here the second and third paragraphs of the original report, as follows:

"The principle of division of labor and concentration of effort, so extensively adopted in the successful prosecution of ends in so many business interests, and that have been so happily practicalized in this body, would seem to apply with peculiar force to our investigations and researches, since we have before us a field so wide, and embracing so many branches of science, that no one man can hope to master them all, or even a considerable number of them, and at the same time pursue the practice of his profession.

"It can, therefore, hardly be doubted that the members of this Association can accomplish more for the advancement of the interests of our profession by persistently pursuing scientific inquiries, as connected therewith, in a single direction or on a limited number of subjects, than by the present system of preparing papers or essays year after year, and each year on different subjects."

This general comparison may be carried more into detail by saying that, by the plan of annual committees, members are appointed thereon in many instances without having been consulted, and thus placed in charge of subjects not consonant with their tastes or inclinations, and with which they are frequently not familiar.

The papers prepared by the committees thus constituted, although of great value in themselves as embodying the views and opinions of prominent gentlemen of our profession, necessarily contain much of repetition, and lose much of force and efficiency by reason of the unavoidable want of system in the treatment and presentation of the various subjects, and the equally unavoidable aspect which they bear of being but the expression of individual views and opinions.

It is believed that in the proposed system of permanent sections, if properly organized and operated, will be found a remedy for this and other objections. Each member of the Association will be free to select for himself that channel of study and labor which his acquirements, his present knowledge, his taste and predilections, or his desire for special instruction, may lead him to prefer. Each section, being permanent in its membership and continuous from year to year, can present to the Association the results of its labors so systematized and well digested as to be most effective; and the talent and ability of those members who will naturally gravitate to each section will, if not immediately, yet in a short time, give to its dictum on the subject under its charge that type of authority that is now accorded to the writings of Agassiz on Natural History, Liebig on Chemistry, Huxley, Leidy, and Marsh on Comparative Anatomy and Physiology, Tyndall on Physics, etc.

While each section is pursuing the investigation of its particular subject in a thorough and exhaustive manner in a scientific point of view, its members will in turn receive the benefits of similar labors of each of the other sections, thus making the results of the special researches of each section and individual enure more effectively to the benefit of the whole Association and the profession at large.

The objections to the adoption of the system of permanent sections would seem to lie, first, in the difficulty always attending the introduction and organization of new machinery; and, second, in the doubt that may arise whether the members, after uniting with a section, would work so as to make its labors effective. These objections, however, would derive all their weight and force from a want of disposition on the part of the membership and not from any inherent defect or disadvantage of the system itself. Should it present itself in so favorable an aspect as to lead to its adoption, there would be certainly little difficulty, after its details are determined, in carrying it into practical operation. This would simply require willing, intelligent, and properly directed effort.

The first step would be the formation of the sections, which is accomplished by each member choosing his subject or special field of labor and enrolling his name in the section having charge of it. The next would be the organization of the sections by the election of chairmen, and, if desired other officers of each section.

Upon this chairman, as its quasi-executive officer, would naturally devolve the duty of conducting and supervising the work of the section — a trust which it is necessary in all large or small organizations to repose in some one — and this duty and trust always carries with it a greater or less amount of labor. The method of investigation and preparation of the work of the sections for report to the Association must, from the diversity of subjects and manner of handling them, be left to a great extent to the judgment of each section, although there should be a general similarity of plan for all.

It is here suggested that the chairman of each section divide his subject into as many parts or heads as a proper analysis or dissection will permit, and by correspondence or otherwise obtain the conclusions of each member of his section upon all or any one or more of these parts and embody these conclusions with his own in the report prepared by him for the Association. Of course these conclusions should be based on careful investigation and supported by facts, because no proposition or statement has any value in a scientific point of view unless so based and supported; and one great object in the introduction and adoption of this system is to bring the diverse views, theories, and propositions which are at this time or may in future come before our profession, to that test, and thus establish and fortify the true and eliminate those having no solid foundation.

It would probably be well for this Association to constitute the chairmen of the several sections a committee to mature and adopt some general plan, and, as far as they can, the details of the work of the sections.

While it would be desirable that all the members of the Association should have the benefit of the discussions elicited in the sections while making up the reports, yet that is impossible. As now, the consideration of the report made would afford the best occasion for profitable discussion and instruction.

It will be readily understood that while the treatment of the past history and former developments of a subject may make the first two or three reports of a section lengthy, yet, when they shall have been disposed of, the current condition of such subject will probably furnish matter for only brief reports, and at that time, therefore, the number of divisions and sections reported in the following resolutions will not be too great, though at present it may seem cumbersome:

Resolved, That the membership of this Association be, and is hereby, divided into twelve permanent sections, each section to be composed of such members as may elect to unite and form that section.

Resolved, That it shall be the duty of each member of this Association to connect himself with some one of these sections, but that he shall be free to follow his own preferences as to the particular channel in which he will labor, and may, if he so desires, be a member of two or more sections.

Resolved, That the members of each section shall, at each annual meeting of the Association, immediately after the regular election of officers, elect in turn and in the order named, a chairman and such other officers as they may see fit, the names of the members of each section being read and the same tellers canvassing the ballot. And it shall be the duty of the chairman so elected to see that the labors of his section are conducted in the manner calculated to secure the best results.

Resolved, That each section shall have charge of one of the following divisions of the subjects or branches essential to scientific dentistry, and through its chairman, or such other member as it may select, report upon the same to the Association at each annual meeting, in the order in which they are named:

1. Operative Dentistry or Dental Surgery.
2. Artificial Dentistry.
3. Anatomy and Physiology.
4. Histology and Microscopy.
5. Etiology.
6. Pathology and Therapeutics.
7. Chemistry and Materia Medica.
8. Metallurgy and Chemistry of the Metals.
9. Dental Education.
10. Dental Literature.
11. Dental Nomenclature.
12. Dental Appliances.

Resolved, That after the several sections shall have been fully organized and in working condition, it shall be the duty of each chairman to furnish the latest and best information in the possession of his section upon any

point connected with its subject, to any member of another section who, through the chairman of his own section, may apply to him for such information. Respectfully submitted.

R. FINLEY HUNT,
W. H. ATKINSON,
H. A. SMITH,
C. W. SPALDING,
HOMER JUDD,
W. H. MORGAN,
J. H. MCQUILLEN, } *Committee.*

The Chairman has failed to receive from Drs. Shepard and Crouse authority to affix their signatures, either favorably or adversely, to the report.

On motion of Dr. Shepard, the report was accepted. It was then moved by Dr. Shepard that the report be laid on the table until after the minority report should be read. Carried.

The report of the Special Committee on Nomenclature and Terminology was then read by Dr. Atkinson, and discussed by himself, Drs. Allen and Taft.

On motion of Dr. Fillebrown, all physicians and dentists not members of the Association were invited to seats in this body.

The resolution offered in the report of the Committee on Nomenclature, etc., by vote, was laid on the table until the report of the Committee on Sections should be taken from the table.

On motion of Dr. McQuillen, the amendment offered at the last annual session, p. 24, in regard to representatives from dental colleges was taken up, and, on motion to adopt this amendment, it was discussed by Drs. Hunt, Rawls, and H. A. Smith. Dr. Rawls moved that the question be postponed until the subject of dental education is brought up. Lost.

Discussion then followed by Drs. Atkinson, Wetherbee, Spalding, McQuillen, Flagg, Pierce, Buckingham, Hunt, Morgan, Abbott, McDonald and Rawls.

Dr. Cushing moved that the subject be referred to a special committee of three. Carried. And Drs. Morgan, Fillebrown and Black were appointed by the Chair.

Adjourned to 7 : 30 P.M.

FIRST DAY—EVENING SESSION.

Association convened at 8 o'clock; President Rehwinkel in the chair. Minutes of previous session read, corrected and approved.

On motion, the regular business was suspended for the transaction of miscellaneous business.

Dr. Stockton reported vacancies in the Committee on Prize Essays, by the absence of Drs. Allport and Judd, which were filled by the appointment, by the Chair, of Drs. Morgan and Pierce.

Dr. Shepard stated his readiness to offer a minority report of the Committee on Sections.

Dr. Spalding moved the report be accepted without reading. Lost.

The minority report was then read, and, on motion of Dr. Shepard, was laid on the table for the present.

MINORITY REPORT OF COMMITTEE ON SECTIONS.

The undersigned, members of the Committee on Sections, did not sign the report with the majority, for various reasons.

They were and are in doubt as to the wisdom of dividing the Association into sections, but as the opinion of the members in favor seems to predominate, they would recommend that the experiment be tried. They would also recommend that at first the sections should be few in number, and then subdivided as may seem desirable. As a resolution is of no effect in opposition to the constitution, they beg now to present, without further argument, a minority report in the following draft of amendments to the constitution:

ARTICLE III.

SEC. 3. Insert the words "and membership of the sections" between the words "to office," at the end of the sixth line, and before the words "none being eligible," at the commencement of the seventh line.

ARTICLE V.

SEC. 6. Strike out the sentence "they shall also report to the Association upon any and all appliances which may be placed in their hands," near the bottom of the seventh page of the *printed* constitution.

ARTICLE V.

SEC. 6. Page 8, under head of "third division" strike out the words "names for standing committees for the ensuing year and" between the words "they shall report" and "the names of places."

ARTICLE VI.

Strike out all five sections of Article VI, and insert a new article, as fol lows:

SECTION 1. To prepare, arrange and expedite business, this Association shall be divided into six sections, as follows:

1. Artificial Dentistry, Metallurgy and Chemistry.
2. Dental Education.
3. Dental Literature and Nomenclature.
4. Operative Dentistry.
5. Anatomy, Physiology, Histology, Microscopy and Etiology.
6. Pathology, Therapeutics and Materia Medica.

SEC. 2. It shall be the duty of each permanent member to inform the Recording Secretary, before the close of the morning session of the third day of the annual meeting, which of the six sections he elects to join for the ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one section during the same year.

SEC. 3. It shall be the duty of the Recording Secretary, immediately after the close of the above morning session of the third day, to make out lists of the names thus furnished of each section, as a basis for the election of officers of said sections.

SEC. 4. The Association shall, by vote, assign some time after the regular election of officers of the Association for the meeting of the several sections for organization.

SEC. 5. When the time for the organization of the sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each section with the list of members of his respective section, which member shall thereupon call the members to order, and read the list of names. The members shall then elect, by ballot, a chairman and such other officers as they may see fit.

SEC. 6. The chairman shall preside at all the meetings of his section; shall exercise general supervision over the business, and shall see that the labors of his section are conducted in the manner calculated to secure the best results. The chairman, or such other member or members as the section shall select, shall prepare and read at the annual meeting of the Association next ensuing, a paper or papers on the advances and discoveries of the past year in the branches included in the section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7. The several sections shall meet at 10 A.M. on the morning of the first day of the annual meeting of the Association.

SEC. 8. For the information of all members a list of the members of each section shall be published in the Transactions of each year.

ARTICLE VIII.

Under "Order of Business" insert between Nos. 1 and 2 the words "two meetings of the sections at 10 A.M."

Change present No. 2 to 3, and have it read "Organization of the Association at 11 A.M."

Change No. 3 to 4.

Change No. 4 to 5, and strike out the words "Standing Committees," and insert the word "sections."

Change Nos. 6, 7 and 8 to 7, 8 and 9.

Strike out all of No. 9.

Respectfully submitted. L. D. SHEPARD.
J. N. CROUSE.

A report was then read by Dr. Dean, chairman of the Committee on Dental Physiology, which was discussed by Dr. Atkinson.

A report was then read by Prof. McQuillen, a member of the same committee, followed by some verbal remarks by himself.

Adjourned.

SECOND DAY—MORNING SESSION.

Association convened at 10:30 A.M.; President Rehwinkel in the chair.

The minutes of the previous session were read, corrected and approved.

On motion, the rules of order were suspended, and the reports of the Committee on Histology and Microscopy were given precedence in the order of business.

Dr. Black, the chairman of that committee, read a report, upon which Dr. Crouse moved that all the reports and papers upon this subject be read before any discussion takes place. Lost.

The report was then discussed by Dr. Spalding.

Dr. Fillebrown moved that the next paper be now read. Whereupon Dr. Waters, a member of the committee, made a brief verbal report.

This was followed by a report of Dr. Pierce, a member of the same Committee on Histology, etc.

The chairman of the Committee on Volunteer Essays reported favorably on an essay presented by Dr. Atkinson and written by Dr. Bödecker. After a brief discussion as to the propriety of re-

ceiving papers from persons not members of this Association — as was the writer of this — the paper was received by a unanimous vote and read by Dr. Atkinson.

Dr. Buckingham made some remarks upon the report of Dr. Black, and was followed by Dr. Atkinson.

Upon motion of Dr. Crouse, amended by Dr. Spalding, it was voted to have an extra session Thursday afternoon, from 4 to 6 o'clock, to consider miscellaneous business: 1. The reports on sections. 2. The certificate of membership, and other miscellaneous business.

Adjourned.

SECOND DAY—EVENING SESSION.

Association convened at 8 o'clock; the President in the chair. Minutes of previous session read and approved.

Dr. Shepard moved that the bills for printing reports of the Committee on Sections, and programme of the order of business, be paid. Carried.

The following resolution, offered by Dr. Shepard, was adopted:

Resolved, That the Treasurer pay all drafts upon him properly authenticated, for salaries, bills of the Publication Committee, and other expenses of this session.

Dr. Spalding moved that the vote making the consideration of the reports on sections the special order of business for to-morrow from 4 to 6 P.M. be reconsidered. Carried.

Dr. Fillebrown moved that the amendments to the Constitution offered in the minority report of the Committee on Sections be adopted.

On vote, all the amendments were unanimously adopted. See page 19.

The regular order of business was resumed, and the subject of Histology was discussed by Drs. Atkinson, McQuillen, Black and Dean.

On motion, the subject was passed.

The Committee on Pathology and Surgery was called, and Dr. Atkinson, the chairman, read a report, which was discussed by Drs. Spalding and Atkinson.

Adjourned.

THIRD DAY—MORNING SESSION.

Association convened at 10 A.M.; President in the chair. Minutes of previous session read and approved.

Dr. Dean read the following report of the Publication Committee, which was adopted.

Your committee would respectfully report: They have published four hundred copies of the proceedings of the last annual meeting, and transmitted copies of the same to such members of the Association as were entitled to receive them, and also to some public libraries, and to the dental journals in this and in foreign countries.

The proceedings of the past year were somewhat larger than those of any preceding year; and though the work of your committee is not as perfect as they could wish, yet they believe the printed Transactions, with some minor faults, which might be expected from the nature of the material collected, and the rapidity with which the work was accomplished, will compare favorably with those of other similar associations.

The following is a statement of their account with the Association:

AMERICAN DENTAL ASSOCIATION, TO THE PUBLICATION COMMITTEE.

			Dr.
1877.	To publication of 400 copies of Transactions		$395 00
	" Expressage, postage and stationery		35 82
			$430 82
Cr.	By cash from former Secretary	$ 17 00	
	" " " Treasurer	400 00	
	" " Transactions sold	15 48	
			432 48
	Balance due the Association		$1 66

M. S. DEAN, *Chairman Publication Committee.*

TREASURER'S REPORT.

WM. H. GODDARD, TREAS., IN ACCOUNT WITH AM. DENTAL ASSOCIATION.

1877.			*Dr.*
August 7.	To balance	$288 64	
	" cash received for dues during the year	770 00	
			$1,058 64

Contra Cr.

1877.	By paid Publication Committee, balance due for 1876	Order No. 1.	$122 63		
	" " Reporter's fee	" " 2.	150 00		
	" " Secretary's salary	" " 3.	100 00		
	" " Treasurer's salary	" " 4.	100 00		
	" " Chairman Local Com.	" " 5.	15 50		
	" " " Pub. Com.	" " 6.	400 00		
	" " Incidental expenses, postage, stationary, expressage, etc.	Order No. 7.	11 85		
				899 98	
1878. August 6.	Balance this day			$158 66	

NIAGARA FALLS, August 6, 1878.

We have examined the Treasurer's report, and find it correct.

L. D. SHEPARD,
M. H. WEBB, } *Auditing Committee.*
J. N. CROUSE,

The subjects of Pathology and Surgery were passed.

Reports on Dental Education were read by Drs. Friedrichs, Fillebrown and the chairman, Dr. Crouse.

Dr. Fillebrown then offered the resolution presented in his report. On motion of Dr. J. Taft, the resolution was laid on the table.

Discussion followed on the reports on Education by Drs. Hunt, Fillebrown, Ingersoll, Taylor, Flagg, John Allen, Wetherbee and Darby.

On motion of Dr. Fillebrown, the following resolution, referred to above, was taken from the table:

Resolved, That we deem it expedient and for the best interests of the practice of dentistry, that existing medical schools so enlarge their curriculum as to include sufficient instruction in dentistry, and thus make the requirements for graduation the same for this as for other specialties of medicine.

The resolution was discussed by Drs. Atkinson, Shepard, Spalding, McQuillen and Ingersoll.

Dr. Buckingham moved the previous question, which prevailed. The main question was then put, and the resolution offered by Dr. Fillebrown, in his report on Dental Education, was lost.

The discussion on Dental Education was resumed, and discussed by Drs. Crouse and Cook.

On motion of Dr. Taft, the Association adjourned to 4 o'clock.

THIRD DAY—AFTERNOON SESSION.

Association convened at 4 o'clock; the President in the chair. Owing to the absence of the Secretary, the reading of the minutes was postponed, and Dr. Odell was appointed Secretary *pro tem.*

Dr. Wetherbee moved that the *design* of the certificate of membership be adopted by this Association.

Dr. Shepard moved, as an amendment, that the word "Honorary" be engraved upon the plate between the words "This is to Certify that" and the words "Members of the."

Dr. Rehwinkel offered the following, as a substitute for Dr. Shepard's amendment:

That this certificate be granted to honorary members and to all worthy members of this Association, provided they have retained their membership for five consecutive years, upon the payment of ——, the cost of certificate.

On vote, the substitute was carried.

Dr. Crouse moved that the whole matter be laid on the table. Carried.

Dr. Buckingham moved that an order be drawn on the Treasurer for the payment of the expenses attending the procuring of the certificate; and, also, that the engraved plate be placed in the custody of the Recording Secretary. Adopted.

Dr. Shepard offered the following:

Resolved, That all cases of excusable delinquency for non-payment of dues be referred to the second division of the Executive Committee for consideration and decision, and that said committee is hereby authorized to remit all or a part thereof, at their discretion. Carried.

Upon Dr. Spalding's motion, the following was adopted:

Resolved, That a Committee of *Five*, on Revision and Engrossment of the Constitution, be appointed by the Chair.

In case no new amendments to the constitution are proposed by said committee, they may, at their discretion, cause to be printed 500 copies of the constitution. This committee shall report at the earliest practicable time.

The following were appointed:

Drs. Spalding, Ambler, Fillebrown, Keely and Black.

Dr. Taft moved the appointment of a Committee of Three, to draft suitable preamble and resolutions relative to the death of Prof. Barker.

Drs. Taft, Cushing and Gorgas were appointed by the Chair.

On motion of Dr. Taft, Prof. Buckingham was added to the committee.

Dr. Shepard moved that the constitution, as amended, be published with the Transactions of this session. Carried.

Adjourned.

THIRD DAY—EVENING SESSION.

Association convened at 7:30; President Rehwinkel in the chair.

The minutes of the morning and afternoon sessions were read and approved.

On motion of Dr. Cushing, the order of business was suspended for the transaction of miscellaneous business.

A telegram was read by the President, from Dr. S. W. Dennis, requesting the Association to delay the selection of the next place of meeting, if practicable, until his arrival.

The motion of Prof. Taft to make this the special order of business for 10 o'clock to-morrow morning was lost.

The Association then proceeded to the selection of the next place of meeting and the election of officers.

Niagara was chosen for the next place of meeting.

The election of officers for the ensuing year resulted as follows:

President — H. J. McKellops, St. Louis.
First Vice-President — L. D. Shepard, Boston.
Second Vice-President — L. D. Carpenter, Georgia.
Corresponding Secretary — A. O. Rawls, Kentucky.
Recording Secretary — G. H. Cushing, Illinois.
Treasurer — W. H. Goddard, Kentucky.
Executive Committee — C. N. Pierce, G. V. Black, G. W. Keely.

Adjourned.

FOURTH DAY—MORNING SESSION.

Association convened at the appointed hour; President Rehwinkel in the chair.

Minutes of the preceding meeting read and approved.

A report was read by Dr. Odell, chairman of the Committee on Therapeutics.

Discussed by Drs. Spalding, Flagg and Atkinson.

The subject was then passed.

On the call for the reports on Operative Dentistry being made, Dr. Shepard stated that the report of the chairman of that committee, Dr. H. A. Smith, had been lost; and on motion, it was

Resolved, That in case said report should be found, or reproduced by its author, it be placed in the hands of the Publication Committee.

Dr. Webb read a report on Operative Dentistry, which was followed by volunteer essays, written and read by Drs. Flagg, Friedrichs, Stockton and D. D. Smith.

On motion of Dr. Crouse, an extra session was voted to be held at 3 : 30 this afternoon.

The subject of Operative Dentistry was passed.

Adjourned to 3 : 30 P.M.

FOURTH DAY—AFTERNOON SESSION.

Association convened at 3:30 o'clock; the President in the chair.

Minutes of previous session read and approved.

Dr. Crouse moved that the subject of the certificate of membership be taken from the table. Carried.

Dr. Crouse moved that the word "Honorary" be engraved in the blank space on the plate. Carried.

And also that an appropriate seal be engraved for the use of the Association. Carried.

Dr. Taft moved that the newly-elected officers now be installed. Whereupon the President introduced Dr. McKellops in a few happy remarks, which were briefly and appropriately responded to by the incoming President.

On motion, the regular order of business was resumed, and a report prepared by Dr. Noel, a member of the Committee on Chemistry, was read by the Secretary, Dr. Cushing.

Discussed by Dr. Atkinson.

On motion, this subject was passed, and the report on Literature was read by Dr. Cook, chairman.

Discussed by Drs. McQuillen, Cook and Atkinson.

On motion of Dr. Shepard, the regular order was suspended for the purpose of organizing sections. The following organization was effected:

Section 1. Artificial Dentistry, Metallurgy and Chemistry.—R. Finley Hunt, Chairman, C. S. Stockton, Secretary; J. G. Templeton, J. G. Ambler, J. S. Cassidy, A. W. Freeman, J. Hooper, J. Ward Hall, H. H. Keith, D. D. Smith.

Section 2. Education.—J. N. Crouse, Chairman; Thos. Fillebrown, C. W. Spalding, W. S. How, J. G. Werner, L. D. Shepard, John Allen, L. C. Ingersoll, G. H. Cushing, T. W. Brophy, W. H. Morgan, K. B. Davis, Jno. M. Hurtt, C. R. E. Koch, J. L. Hill, J. A. Watling.

Section 3. Dental Literature and Nomenclature.—W. H. Atkinson, Chairman, J. Taft, Secretary.

Section 4. Operative Dentistry.—I. J. Wetherbee, Chairman, W. H. Goddard, Secretary; H. A. Smith, Wm. M. Reynolds, Wm. H. Allen, Geo. J. Friedrichs, Geo. W. Keely, Isaac Douglass, Jas. McManus, Geo. B. McDonald, Isaiah Forbes, G. C. Daboll, E. S. Gaylord, E. Honsinger, F. A. Hunter, H. H. Jackson, C. I. Keely, J. Frank Marriner, W. N. Morrison, Edmund Noyes, E. Osmond, S. B. Palmer, F. M. Shriver, Geo. R. Thomas.

Section 5. Anatomy, Physiology, Histology, Microscopy and Etiology. —M. S. Dean, Chairman, M. H. Webb, Secretary; J. H. McQuillen, C. N. Pierce, G. F. Waters, W. C. Barrett, W. E. Hoag, Merritt Wells, G. V. Black, J. W. Rhone, M. S. Chaim, C. F. Wheeler, D. C. Hawxhurst, H. A. Mansfield, L. G. Noel, C. P. Pruyn.

Divided into three Sub-sections. J. H. McQuillen to report on Anatomy and Physiology; C. N. Pierce to report on Histology and Microscopy; M. H. Webb, to report on Etiology.

Section 6. Pathology, Therapeutics and Materia Medica.—F. H. Rehwinkel, Chairman, Will Taft, Secretary; F. M. Odell, Edgar Palmer, G. W. Klump, L. D. Carpenter, A. W. Smith, S. W. Dennis, C. A. Brackett, W. O. Kulp, Gorton Nichols, H. L. Sage.

Committee on Credentials made their final report, which will be found in its usual place.

Committee on Prize Essays made the following report:

Your committee would report that they have had placed in their hands one essay only, which, they are informed by its author, is the same which was rejected last year. Your committee do not feel warranted in reversing the decision of the previous committee.

C. S. Stockton,
C. N. Pierce, } *Committee.*
W. H. Morgan,

Report of Committee on Appliances was read by Dr. Fillebrown, and referred to the Publication Committee.

The special committee to revise the resolution offered by Dr. Fillebrown on colleges reported the following:

Your committee to whom was referred the proposed amendment to the Constitution relative to dental colleges, beg leave to offer the following report:

That we deem it inexpedient at this time to make any change in the Constitution relative to this subject, but would recommend the passage of the following resolution:

Resolved, That this Association disapproves of the practice of dental colleges in graduating students upon less than two full courses of lectures,

and believe it to be detrimental to the interests of dental education, and advise the omission of such inducements from their annual announcements.

Respectfully submitted.

W. H. Morgan,
Thomas Fillebrown, } *Committee.*
G. V. Black,

Dr. Hunt moved to refer it to Section on Education.

Dr. McQuillen amended, to adopt, which prevailed.

Upon motion of Dr. Shepard, Dr. Spalding's motion, passed yesterday, on revision of the Constitution, was reconsidered.

On Dr. Shepard's motion, it was amended by striking out the clause authorizing the committee to print.

Dr. Shepard moved that the Publication Committee be instructed to publish as many pamphlet copies of the Constitution as they might deem necessary. Carried.

Dr. Taft reported resolutions on the death of Professor Barker, which were unanimously adopted, and will be found on the memorial page.

Upon motion of Dr. Taft, a vote of thanks was tendered to the retiring officers; also, on motion of Dr. Fillebrown, to the Buffalo "Courier" and its reporter.

Upon motion of Dr. Taft, a vote of thanks was tendered to the proprietors of the hotels and the railroads for courtesies rendered.

The President appointed Drs. Crouse and Keely on the Publication Committee.

He also appointed as a Committee of Local Arrangements, Dr. Field, of Detroit; Dr. Freeman, of Buffalo, and Dr. Will Taft, of Cincinnati.

The minutes of the afternoon session were then read and approved, and the Association adjourned to meet at Niagara Falls on the second Tuesday of August, 1879.

In Memoriam.

WHEREAS, In the wisdom of Divine Providence, our colleague, Professor GEORGE T. BARKER, Vice President of this Association, has been removed by death from our midst, in the prime of his manhood; therefore,

Resolved, That we feel called upon to testify, in this manner, our appreciation of his usefulness as a member of our profession.

Resolved, That we deplore his loss, and regard his example, both professional and social, as eminently worthy of emulation.

Resolved, That the sympathy of the members of this Association be and hereby is tendered to the bereaved family of our lamented brother.

Resolved, That the above testimonial be inscribed in the minutes of this Association, and printed upon a memorial page in the Annual Transactions.

AMENDED CONSTITUTION,

ADOPTED AT SARATOGA, AUGUST, 1869.

WITH AMENDMENTS UP TO AND INCLUDING THE SESSION OF 1878.

ARTICLE I.

NAME.—This organization shall be known by the name of the AMERICAN DENTAL ASSOCIATION.

ARTICLE II.

OBJECTS.—The objects of this Association shall be, to cultivate the science and art of Dentistry, and all its collateral branches; to elevate and sustain the professional character of Dentists, to promote among them mutual improvement, social intercourse and good feeling, and collectively to represent and have cognizance of the common interests of the Dental Profession.

ARTICLE III.

SECTION 1.—MEMBERSHIP, NUMBER OF DELEGATES FROM LOCAL SOCIETIES.—Each local society may send one for every five of its active members, and each Dental College one from its faculty, as delegates to this Association, for one year, upon complying with the requirements of its Constitution; but no society shall be entitled to representation that does not adopt or substantially recognize its code of ethics.

SEC. 2.—EXPELLED MEMBERS.—Any member of this Association, being expelled from his local society, shall from that date cease to be a member of this body.

SEC. 3.—MEMBERS TO BE OF THREE CLASSES.—The members of this Association shall be of three classes, viz: Delegates, per-

manent, and honorary members; the two former classes having equal rights and privileges, except eligibility to office and membership of the sections — none being eligible to hold office except permanent members; the latter class to consist of prominent, worthy members of the dental profession residing in foreign countries, who shall be elected by ballot.

SEC. 4.— DELEGATES.— All delegates shall be practitioners of Dentistry; they shall receive their appointment only from permanently organized Dental Societies and Dental Colleges, having definite conditions of membership other than pecuniary, which shall have been approved by the Executive Committee, and a copy of which shall be in the hands of the Recording Secretary of this body.

This Association will hereafter receive no delegate, who shall, after this date, enter the profession without first having graduated at some reputable dental or medical college.*

SEC. 5.— PERMANENT MEMBERS.— Permanent members shall consist of those who, having served one year as delegates, and complied with the requirements of the Association, shall signify to the Treasurer a desire for permanent membership.

SEC. 6.— SIGNING CONSTITUTION.—Each new member, before voting or speaking on any subject before the meeting, shall sign these regulations, inscribing his name, and the title and location of the institution from which he receives his appointment.

SEC. 7.— DUES.— Five dollars shall be paid to the Treasurer by each member yearly, as dues, before he can be eligible to office, or speak or vote on any subject before the Association; and in case the dues remain unpaid at the close of the second annual meeting thereafter, the name of any such delinquent shall be erased from the list of members without further action.

SEC. 8.—GIVING NAME ON RISING.—No one shall be permitted to address the Association before giving his name and residence, which shall be distinctly announced from the chair; nor shall he speak more than twice, nor longer than fifteen minutes in all, unless by consent of the Association.

SEC. 9.—CONDUCT OF MEMBERS.—Any act of special immorality or unprofessional conduct, committed by a member of this

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* This amendment takes effect from and after its adoption, session of August, 1875.

Association, shall be referred to the Executive Committee (second division), whose duty it shall be to thoroughly examine into the case, and report at the next meeting, if the charges be sustained. Whereupon, by a vote, the offending member may be reprimanded or expelled, a two-thirds vote being required for expulsion, a majority being sufficient for reprimand.

ARTICLE IV.

Time of Meetings.—The regular meetings of the Association shall be held annually, and commence on the first Tuesday in August. The place of meeting shall be determined each year by vote of the Association. After the selection of a place of meeting, there shall be appointed by the President, annually, a committee of three, residing at or near the place selected for the next meeting, whose duty it shall be to procure rooms for meetings, clinics, and for the exhibition of mechanical appliances, and to make such other local arrangements as may be needed for the Association. This committee shall act under the direction of the first Division of the Executive Committee.

ARTICLE V.

Section 1.—Officers: how Elected.—The officers of this Association shall be a President, two Vice-Presidents, Corresponding Secretary, Recording Secretary, Treasurer, and the Executive Committee, who shall be elected by ballot without nomination. The three names, or in case of a tie, the four names, having the greatest number of votes, shall be the sole nominees in case of failure to elect on the first ballot, and a majority of all the votes cast for those names shall be necessary to a choice.

Each officer, except as otherwise provided, shall hold his appointment for one year, or until another is elected to succeed him.

Sec. 2.—President: Duties of.—The President shall preside according to parliamentary usage, as laid down in Cushing's Manual, and the rules of order adopted by this Association.

Sec. 3.—Vice-Presidents.—In the absence of the President, one of the Vice-Presidents shall perform the duties of the office; and in the absence of these officers a chairman *pro tem.* shall be appointed by acclamation.

SEC. 4.—CORRESPONDING SECRETARY.—The Corresponding Secretary shall attend to the correspondence of the Association with the societies therein represented, and to correspondence with other scientific bodies as may be desirable.

SEC. 5.—RECORDING SECRETARY.—The Recording Secretary shall keep accurate minutes of the proceedings of the Association, preserve the archives and unpublished documents, and attend to the other duties that pertain to his office. He shall be *ex officio* chairman of the Publication Committee, and shall see that due notice is given of the time and place of meeting of the Association.

SEC. 6.—EXECUTIVE COMMITTEE.—The Executive Committee shall be the business committee of the Association, and shall consist of nine members, to whom shall be referred all business not otherwise specially provided for. They shall report at each meeting, under the proper head, their doings for the current year.

SUB-COMMITTEES.—FIRST DIVISION: COMMITTEE OF ARRANGEMENTS.—Three members of this committee shall act as the Committee of Arrangements, and shall procure suitable accommodations for the meetings and clinics, and for the exhibition and examination of appliances, of which they shall have the charge. These three shall attend generally to the wants of the Association during its session.

SECOND DIVISION: CREDENTIALS AND AUDITING COMMITTEE.—Other three shall examine and verify the credentials and qualifications of members, including all violations of the code of ethics and the constitution, and shall also be the auditing committee for that year.

THIRD DIVISION: COMMITTEE ON NOMINATIONS AND VOLUNTEER ESSAYS.—The remaining three shall examine all volunteer essays, and before they are read to the Association shall give their approval, in order that time may not be taken up by unworthy or irrelevant matter.

They shall report the names of places for the next meeting.

PUBLICATION COMMITTEE: HOW APPOINTED.—Immediately after the election of new members to the Executive Committee, two from that committee shall be appointed by the President to act in conjunction with the Recording Secretary, as the Publication Committee. They shall be authorized to employ a competent

reporter to furnish an accurate report of the proceedings of each meeting.

Instructions to the Publication Committee.—They shall superintend the publication and distribution of such portions of the Transactions as the Association may direct, or the committee judge to be of sufficient value. They shall specify in the annual report of this committee the character and cost of the publications of the Association during the year, and the number of copies still on hand.

Disclaimer.—This committee is hereby instructed to print, at the beginning of each volume of the Transactions, the following disclaimer, viz: "The American Dental Association, although formally accepting and publishing the reports of the various Standing Committees, and the essays read before the Association, holds itself wholly irresponsible for the opinions, theories, or criticisms therein contained, except when otherwise decided by special resolution."

Reports of Sub-Committees.—Each of these sub-committees shall report from time to time, as may be necessary, to the Executive Committee as a whole, who shall decide upon such report if possible; but in case of their inability to decide upon any matter, it shall be brought before the Association for its decision as early as practicable.

Classification of Executive Committee.—At the first election of this committee, the first three shall be elected to serve three years, the second three for two years, and the last three for one year, and thenceforward three new members shall be elected each year by ballot, to serve three years, and in case of the absence of any member of this committee his place may be temporarily filled by the remaining members of the committee.

Meetings of Executive Committee.—The Executive Committee shall, if possible, meet for consultation and arrangement of their respective duties on the day preceding the annual meeting of the Association, and shall meet for the examination of credentials, the arrangement of appliances, and the reception of papers, and such other business as may properly come before them, at 8 a.m. on the day of the annual meeting.

Subdivision of Executive Committee.—They shall also meet, after the election of new members to the committee, to choose their own chairman and secretary, and to divide themselves into sub-

committees, as hereinbefore provided, and for the purposes described.

CHAIRMAN MAY CONVENE THE COMMITTEE.—The chairman of this committee may, at his own discretion, summon the members thereof to a meeting, at any suitable hour during the sessions of the Association.

SEC. 7.—TREASURER TO ATTEND, TO RECEIVE DUES, AT 8 A.M.—The Treasurer shall hold all the moneys belonging to the Association, and shall keep an accurate account as between the society and its members. He shall attend the meeting of the Executive Committee at 8 A.M., on the day of the annual meeting, to receive dues, and shall attend at roll-call to verify the list of names, checking all such as are in arrears for dues; he shall restore such names upon payment of dues within the legal limits, and shall notify all whose names may be erased from the list of membership. He shall pay the drafts of the President, countersigned by the Secretary, upon vote of the society only, and shall report to the Executive Committee, where his accounts shall be audited, and by whom his report shall be presented to the Association, together with their own.

ARTICLE VI.

SECTION 1.—To prepare, arrange and expedite business, this Association shall be divided into six sections, as follows:

1. Artificial Dentistry, Metallurgy, and Chemistry.
2. Dental Education.
3. Dental Literature and Nomenclature.
4. Operative Dentistry.
5. Anatomy, Physiology, Histology, Microscopy, and Etiology.
6. Pathology, Therapeutics, and Materia Medica.

SEC. 2.—It shall be the duty of each permanent member to inform the Recording Secretary, before the close of the morning session of the third day of the Annual Meeting, which of the six sections he elects to join for the ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one section during the same year.

SEC. 3.—It shall be the duty of the Recording Secretary immediately after the close of the above morning session of the third

day, to make out lists of the names thus furnished of each section, as a basis for the election of officers of said sections.

SEC. 4.—The Association shall, by vote, assign some time after the regular election of officers of the Association, for the meeting of the several sections for organization.

SEC. 5.—When the time for the organization of the sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each section with the list of members of his respective section, which member shall thereupon call the members to order, and read the list of names. The members shall then elect by ballot, a chairman and such other officers as they may see fit.

SEC. 6.—The chairman shall preside at all the meetings of his section. Shall exercise general supervision over the business, and shall see that the labors of his section are conducted in the manner calculated to secure the best results. The chairman, or such other member or members as the section shall select, shall prepare and read at the annual meeting of the Association next ensuing, a paper or papers on the advances and discoveries of the past year in the branches included in the section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7.—The several sections shall meet at 10 A.M. on the morning of the first day of the annual meeting of the Association.

SEC. 8.—For the information of all members, a list of the members of each section shall be published in the transactions of each year.

ARTICLE VII.

QUORUM.—Fifteen members shall constitute a quorum for the transaction of business in this Association.

ARTICLE VIII.

SUSPENDING RULES: THREE-FOURTHS TO VOTE.—This order of business may be temporarily suspended by a three-fourths vote of all the members present, for the consideration of a specific subject, upon the completion of which the regular order shall be at once resumed.

ORDER OF BUSINESS.

1. Meeting of the Executive Committee, filling of vacancies therein, examination of credentials and payment of dues, 8 A.M.
2. Meetings of the sections at 10 A.M.
3. Organization of the Association at 11 A.M.
4. Calling the roll of qualified members.
5. Reading of the minutes, and action thereon.
6. The reading and consideration of the stated annual reports from the sections, together with volunteer papers upon the same subjects, in their consecutive order.
7. Report of Executive Committee.
8. Balloting for the place of next annual meeting.
9. Election of officers and three members of Executive Committee.
10. Instructions to the Permanent Committees.
11. Unfinished, new and miscellaneous business.
12. Adjournment.

AMENDMENTS.

Alterations and amendments may be made in the foregoing Articles or Rules of Order, at any annual meeting, by the consent of all the members present. Otherwise notification in writing shall be made of any such proposed alterations or amendments, and laid over for one year for final action, when they can only be adopted by an affirmative vote of two-thirds of the members present.

RULES OF ORDER.

1. On the arrival of the hour of meeting, the President shall take the chair, call to order, and announce that the meeting is open for business.

2. No motion or speech shall be in order until the mover or speaker shall have been recognized and assigned the floor by the Chair, nor shall a motion be open for debate until seconded and stated by the Chair.

3. At the request of any member a motion shall be put in writing.

4. At the request of five members a question shall be divided, or the yeas and nays ordered.

5. When a question is under debate, no other motion shall be in order, except—1st, to adjourn; 2d, to lay on the table; 3d, the previous question; 4th, to postpone; 5th, to commit; 6th, to amend; and these motions shall take precedence in the order here stated.

6. The previous question, and the motions to adjourn, to lay on the table, and to postpone, shall be decided without debate.

7. A motion to adjourn shall always be in order, but no member can make such a motion while another is speaking, or while a vote or ballot is being taken.

8. A second amendment to the main question shall not be in order until the first is disposed of, nor shall there be an amendment of an amendment to an amendment.

9. After a motion has been seconded and stated by the Chair, it shall not be withdrawn without the consent of the Society.

10. No member shall interrupt another while speaking, except to call him to order.

11. When called to order, a member shall sit down until the point of order is decided by the Chair, or, in case of appeal, by the Society. If the point of order be sustained, the member can proceed in order by the consent of the Society.

12. Every member shall vote upon a question unless excused by the Society.

13. When any motion, except to adjourn, has been rejected, it shall not be renewed without unanimous consent.

14. Any member who voted in the majority may move a reconsideration of that question, but if that motion shall be lost or laid upon the table, it shall not be renewed without unanimous consent.

15. The President may vote with the members upon all questions, but, having so voted, shall not give the casting vote in case of a tie.

16. Motions for filling blanks shall be put in the order in which they are moved.

17. On a division, or in voting by yeas and nays, any member may change his vote before the result is declared.

18. These rules may be suspended by unanimous consent.

REPORTS

OF

STANDING COMMITTEES,

VOLUNTEER ESSAYS,

AND

DISCUSSIONS.

REPORT OF COMMITTEE

ON

DENTAL NOMENCLATURE & TERMINOLOGY.

By W. H. ATKINSON.

ON the 26th day of June, 1878, I received a letter from Prof. J. Taft, informing me that, in all probability, neither he nor Prof. Judd, the other member, and chairman of the committee, was likely to attend the coming meeting of the American Dental Association, and neither of them being able to prepare and send a report, he would throw the responsibility of that duty upon me.

In view of these circumstances, and my unwillingness to have the committee fail to perform its appointed work, I have determined to do what I can.

For a testimony of the necessity of such a work as has been imposed upon this committee, we need look no further than to the construction of the resolution, a vote upon which, by the American Dental Association, called this committee into being.

Dentistry, as an art, is, properly speaking, an applied science, in so far as it rises above the category of mere empiricism. It is the same with every art. The arts are the sciences in practice or action. As an art, dentistry has technicalities which spring up out of the mere conveniences of the workshop, which have been spontaneously applied by the workmen, and which are generally better than anything which would result from any amount of learned study on the subject. It is not desirable, nor is it proposed, to reform this kind of technicals. But there is quite another kind of technicals, which concern dentistry in common with the sciences, to which dentistry, in its scientific aspect, pertains, and of which it is a branch.

The teeth are a part of the bony structure, and the science of the teeth, as structures, is therefore a part of osteology; this, in turn, is a branch of anatomy, etc. Tracing the matter back in this manner, we come to the science of macro-physiology, of which anatomy is but a part; and thence to chemistry, mechanics, and even to astronomy and mathematics. Indeed, the fundamental universological idea that there is, at bottom, but one science, of which all the so-called special sciences are branches, is just at this time rapidly taking strong hold of the minds of the scientific world.

Seen from this point of view,—the scientific nomenclature of dentistry,—those technicalities which are not merely of the shop, are, or must become, the same as the ultimate technicalities of all science. But these technicalities of universal science, as ultimate, are not yet properly constituted into system anywhere. If they were so, we should only have to adopt them. The universologists are only laboring at them, and perhaps need as much help from us, and other specialists, as we need from them.

To give some idea of what is meant by a nomenclature applicable to all the sciences, and based on ultimate analysis, let us treat a little of the so-called atom and molecule. These are, in some sense, the very starting-points of terminology; and yet they are not adequate to meet the present demands of science. Atom is derived from Greek words which mean, *the least thing*, or, strictly, *that which is indivisible;* that, than which, there can be nothing smaller. But do we really know that there is any least thing? The word raises the query of the infinite divisibility of matter, and professes to decide the question. Still there remain two parties to this investigation, and our technicality should be one that would be equally acceptable to either party.

We may lay it down as our first business, as founders of nomenclature, if we seriously undertake that task, to keep clear of special theories in respect to the facts, and about which there is, or may be, dispute; and to confine ourselves strictly to furnishing the instruments, or that armory of vocal implements by which anybody, whosoever and whatsoever his theory or opinion, may be able, intelligibly, to present his ideas to all others.

Within a committee, working on this subject, there is no better test of their success than the selection of terms which avoid their

individual points of difference, while they obviate misunderstanding and clearly communicate the ideas of each.

To return to the word atom. There are, in its assumption, other sources of difficulty. It implies a real body, though as if it were infinitely minute. But one school of scientists denies that there are any such real bodies, and substitutes the idea of points of force. Again, the ethereal atom, affected by the tensions of electricity, as conceived by Faraday, is something many millions of times, perhaps, finer than the chemical atom, which we have already assumed to be the least thing, and indivisible. Various other difficulties are involved in the assumptions implicitly made in the meaning of the term atom. Similar difficulties not so striking affect the term molecule, since it is made up of atoms, and connotes the meaning of atoms.

We will now point out how it would be possible to evade these difficulties by discarding these terms and substituting new ones.

Universology distributes Form into four grand departments. These are:

1. Punctiform, or Form made up of Points.
2. Liniform, or Form made up of Lines.
3. Planeform, or Form made up of Planes or Surfaces; and
4. Solidiform, or Form made up of Extended Volumes, or solidities in the geometrical sense.

The domain of chemistry, histology and embryology is peculiarly punctiform; but in all these the point which is virtually what we call the atom is something more than a geometrical point. It has either a flesh-like substance, or is endowed with forces, or it is both. But still it is *like* the geometrical point; a roundish and minute entity or concept. Suppose, then, we adopt the term *punct* to mean any such roundish or point-like object or conception, without assigning to it any definiteness of any other kind; that is to say, for instance, without deciding whether it is a merely geometrical point or an atom (so called), and, if an atom, whether a body or a mere minute focalization of force, or whether it is both; and suppose that we take this root *punct* (from the Latin *punctum*, a point) as a stem upon which to build more extended and definite terms to denote the particular aspects of the idea.

For example, let us now say *punct-it* to denote a point not having any real body, and not implying any force or forces; *punct-id*,

for the so-called chemical atom, conceived of as a body of ultimate minuteness in the chemical series, and *merely as body; punct-ij*, for such a body endowed with and exerting forces; *punct-ich*, for a point without body, but exerting forces — a mere center of force; *punct-ule* for the ethereal atom, less than the chemical atom, etc. Phoneticians will perceive the appropriateness of the uses here made of the light and heavy consonant sounds, *t*, *ch*, *d* and *j*. The Greek language cannot be looked to to furnish technicalities with such minute and precise discriminations of meaning; and so we must follow the universologists in having recourse to the inexhaustible fountain-head of pure phonetics, not discarding Greek and Latin derivation, however, when it is applicable.

It is not necessary to go further, at this time, in this kind of illustration. A word should be said on the special difficulties which beset the inauguration of a true nomenclature.

1. First and foremost is the difficulty of getting completely at the bottom of the understanding of the subject.

2. Second may be mentioned the *usus loquendi*, or the prevalence of popular and unscientific expressions.

3. Individual idiosyncrasies and professional proclivities and habits, including that natural conservatism which sets itself frequently against all innovation or change.

4. Professional pedantry, which would prefer to use a learned and obscure phrase or term, defeating the understanding of the hearer, to employing a plain and simple utterance which would effectively convey the idea.

A statement of the details requisite to justify these recommendations or suggestions would really be doing the work of the whole section to which it belongs, which is quite beyond the present power of your committee, as it is a work that can only be complete after the earnest efforts of many minds for laborious years of work.

Your committee would respectfully recommend a change in the name of Section 11; from "Dental Nomenclature" to "Nomenclature, and the Correlation of Dentistry with Science at Large."

DISCUSSIONS.

Dr. JOHN ALLEN: As Dr. Atkinson has gone to the root of this subject, I shall only make a few remarks upon one or two practical points that suggest themselves to me. I think there is a great deal in our profession that requires improvement in the direction that the doctor has pointed out; for example, our nomenclature in reference to "Mechanical Dentistry." I think "Mechanical Dentistry" is a term that does not express what is embodied in the general acceptation of the term. We all know what it means, but it signifies to us a great deal more than is expressed in the simple term "Mechanical Dentistry." For example, a mechanic works by rule and scribe; he can make a thousand wheel-barrows or wash-tubs by a given design, and every one will meet the requirements for which it was intended. Not so in "ARTIFICIAL DENTISTRY," a term which I much prefer to that of "Mechanical Dentistry." We never have two cases precisely alike; each case requires some new device; therefore the dentist has to draw upon his own mind, and his artistic skill must be employed, in order to combine art with mechanism in such a degree as to meet all the cases which occur in dental practice.

The man who constructs artificial dentures should be a good physiognomist, a good physiologist and a good anatomist. He must know the origin and insertion of every muscle of the face, for it is important to raise the sunken muscles, which have become depressed in consequence of the loss of the natural dental organs, and thus restore the original contour of the face. He must employ art to do this, and his art must harmonize with the laws of nature, which should govern him in these cases. He should also carefully study expression, and many other points in the construction of artificial dentures which do not really come under the head of "Mechanical Dentistry." Therefore, I take exception to the term "Mechanical Dentistry," for the reason that it only expresses a part of what is meant to be conveyed by it.

REPORT OF COMMITTEE

ON

DENTAL PHYSIOLOGY.

By M. S. DEAN, Chairman.

SINCE our last annual assembling very little has been discovered that is actually new in the domain of Dental Physiology. The modified interpretation of facts already discovered, or the more complete establishing of theories by verifying evidence, will be the chief, though not, I trust, the only, achievement of the physiologist of the present day.

The substance of the report, then, which I now offer, will necessarily strike the ear of this audience with more or less familiarity. I shall, nevertheless, endeavor to furnish, at least, some materials for your discussion and elaboration; this I believe to be one of the objects for which the Standing Committees were constituted. I will commence with

The Rudimentary or Abortive Dental Organs of the Ruminants.

You are aware that there is a wide-spread belief, which had its origin in the announcement of Goodsir, in 1838, that rudimentary incisor teeth may be found in the embryonal jaws of ruminants. This statement, founded upon certain anatomical appearances, was seized upon by Darwin, Hæckel and other scientists, to sustain their views regarding the changes that had taken place in the successive generations of animal beings, and thus the theory received additional credit and a fresh impulse until it has now become a prevailing belief that the upper jaws of the fœtal ruminants contain the germs of teeth, which, however, disappear before, or soon after, the birth of the animal.

This conclusion of Goodsir, which was never carefully verified, has recently been severely shaken, if not entirely overthrown, by the researches of Dr. Pietkiewicz, a former pupil in the laboratory of Prof. Robin.

The observations of this French histologist are recorded by Drs. Legros and Magitot, in their treatise on the *Origin of the Dental Germs*, *etc.*, and are supported by the testimony of these authors.* As the facts given by Dr. Pietkiewicz, in a note in the above-named treatise, may be of interest to this body, I will give a brief synopsis of them here.

He says that in attempting to verify the statement of Goodsir, which had obtained such extensive circulation and credit, he made experiments upon a series of preparations of fœtal cattle and sheep, taken in large numbers, from the earliest period of embryonal life until they had attained thirty centimeters, or one foot, in length. In this series of investigations, he not only never witnessed the presence of a dental germ, but never found even a trace of the epithelial lamina.

He further states, however, that in the commencement of his work he was led into an error by the deceptive appearance of the sections made entirely from the *anterior* portion of the jaws; for in these, he found on each side of the median line an epithelial sac, which extended from the mucous membrane into the depth of the jaw, and which *appeared* to constitute the commencement of dental germs, such as Goodsir undoubtedly conceived them to be. No difference was observed between the epithelium of this sac and that of the mucous membrane, of which it appeared to be a depression. The Malpighian layer constituted its outer investment, while in its interior was found pavimentous epithelium.

From this appearance, he thought, one could easily conceive how Goodsir might have been led into the belief that he had discovered dental germs. But in continuing to make sections from these jaws in a *posterior* direction, he found that the little sac assumed the form of a circular canal, and approached the mucous membrane of the nasal fossæ. Around this canal appeared a cartilaginous cornet, and in the upper part was a mass containing vessels. From this he recognized the organ of Jacobson. There was

* See "Origine et Formation du Follicule Dentaire chez les Mammifères," by Drs. Legros and Magitot. Paris. 1873.

absolutely nothing, he says, that could be, even remotely, compared to the germs of the incisor or canine teeth.

The above is a greatly abbreviated epitome of the description given by Dr. Pietkiewicz, but it is sufficient for the present purpose.

Professor Tomes, in his late work, makes the following corroborative statement in regard to this matter: "Some teeth have disappeared utterly; thus the upper incisors of ruminants are gone, and no rudiments exist at any stage, though statements to the contrary have been made and copied from book to book without verification."

From the foregoing it would seem that this theory, originated by Goodsir, and so generally accepted both by scientists and the people at large, must be most rigorously verified or abandoned altogether.

We will next bring to your notice the question of

Third and Fourth Dentitions.

In a recent work, Dr. Magitot, after reviewing the accounts, ancient and modern, relative to the eruption of third and fourth sets of teeth, concludes with the statement that the reports of such cases must be rejected as apocryphal, they not having been examined and reported with sufficient scientific accuracy. He considers such cases to be either the normal or the supernumerary teeth, which, though developed at the normal period, had from some cause delayed their appearance above the surface of the gums until a late period in life.

If these views are correct, we are deprived of one of the poetical illusions we had entertained of returning juvenescence in our old age.

In my own practice I have never encountered a tooth which I could class among those of the third dentitions.

A few months ago I saw a newspaper paragraph reporting a case of third dentition in the mouth of a gentleman of over seventy years of age. On communicating with a dentist who resided in the same town with the septuagenarian, I learned that the only foundation for this statement was the emergence of a root of a molar above the gum. A few days after this I saw another newspaper item, according to which an old gentleman in Brooklyn,

New York, had just erupted a third set of teeth. I instituted inquiries in that city through Dr. Cook, but no person could be found there who had even heard of this miraculous case! *

The physiological obstacles to the development of a third set are presented by Dr. Magitot as follows: "It is well known at the present day that the genesis of the dental follicle has for mechanism a series of evolutionary acts, having for point of departure either the embryonal epithelial band (as in the deciduous teeth), or a derivation from the epithelial cord of the temporary teeth (as in the corresponding permanent teeth). Now, in the case of the aged, after a total loss of these two sets of teeth, the alveolar borders are entirely deprived of all the conditions requisite for such an evolution. Nothing in the mucous membrane that clothes the jaw resembles the epithelial band from which these teeth originated; and the disappearance of all the teeth prevents any derivation from a preëxisting follicular cord.

"Now, if an eruption occurs in the jaws of a *macrobite*, the phenomenon is limited, in general, to the production of one, or at most, two teeth; and these necessarily and invariably enter the category of *tardy eruptions*." †

Although my own views in regard to these anomalies were founded entirely upon reported cases, the most remarkable of which occurred in European countries; yet they were detailed with such minuteness and apparent accuracy, that I had no doubt of their verity.

But since reading the views of Dr. Magitot, who has had such ample opportunities of observation and investigation, I shall abandon my preconceived belief until I learn of at least one well authenticated case.

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* Since the reading of this report, the following appeared in the Chicago "Times": "The Iowa City 'Press' *says that an old lady, sixty-eight years of age, living at Pleasant Valley, is cutting a complete set of teeth, above and below.*"

I regret not having been able to obtain such *positive* information regarding this case as I could desire; although, to my mind, it is sufficiently conclusive. I learn from Dr. Pearce, who, in compliance with my request, has kindly taken the trouble to investigate the facts in question; that, although he had not personally seen the lady above referred to, he had made inquiries of her sister, and other members of the family—whose observation such a remarkable event could not have escaped — all of whom pronounce the report untrue.

These three spurious cases that have come to my notice within as many months, are doubtless of the same character as those heretofore recorded as veritable third dentitions.

† See "Traitè des Anomalies du Systême Dentaire chez l'Homme et les Mammifères," by Dr. E. Magitot, p. 214–15. Paris, 1877.

If reports of occurrences of this nature in the *future* are as groundless as the two I have just referred to, it will be some evidence that the cases reported in distant lands and at remote periods were not examined with sufficient scientific accuracy.

It is wonderful the rapidity with which any such marvelous accounts spread, and the readiness with which they are seized upon by truly scientific persons and made to support their peculiar views. This is well illustrated in the case of one Julia Pastrana, "a celebrated danseuse, whose whole body was covered with hair, and her face adorned with a luxuriant beard."

Darwin, in support of his theory of the correlation of growth existing between the hair and the teeth, reported this woman as having *two rows* of teeth in each jaw. Afterward this remarkable case is referred to by an equally scientific gentleman, at a meeting of the Odontological Society of Great Britain, by whom Julia Pastrana is declared to have "an *excessive number* of teeth."

At a later date, reports of this celebrated case having reached the ears of Dr. Magitot, he procured impressions of the jaws of this "danseuse," and the following is his description, somewhat abbreviated: "In the lower jaw the right *canine* and the *two wisdom* teeth were wanting; in the upper jaw there were only two incisors, instead of four, and the wisdom teeth were wanting. Though the dental system was notably reduced in number, it was quite irregular, and the hypertrophied condition of the gums probably exaggerated the prognathous appearance recognized in the profile of this person."

Now, according to the first of these scientists, Julia Pastrana was endowed with *two rows* of teeth in each jaw; according to the second, she had "an *excessive* number of teeth"; while from the more minutely detailed description of the third, she had only twenty-five teeth in all,—seven less than the normal number!

I mention these discrepancies merely to show how liable are scientific men, even of the *present* day, to be led into errors in regard to the teeth; and with how much greater caution the marvelous statements of men of a much earlier day, before dentistry became a science, should be regarded.

It is to be hoped that the profession will in future search out and carefully examine all cases of anomalies of teeth that they may hear of, and report the results in our journals or our associations.

The Form or Configuration of the Tooth; is it dependent upon the Dentine-Papilla or upon the Enamel-Organ?

This is a question which, so far as I am aware, has been but little discussed, and upon which authors, not silent, generally favor the domination of the dentine-papilla.

Indeed, I had not supposed until quite recently that any physiologist entertained the opinion that the form of the crown was determined or governed by the enamel-organ. I find, however, that this theory is entertained by Dr. Magitot, in his work on *Anomalies*, just cited, though he says little in its support; in fact, he mentions the subject only incidentally, in explaining his theory of "*displacement*" or "*follicular migration.*" He there says: "It is explicitly admitted that the epithelial cord, or enamel-organ, dominates and determines the *place* and the *form* of the tooth. The genesis and development of the dental *bulb* (dentine-germ) which makes its appearance subsequently to the cord, is absolutely dependent, as a physiological consequence, upon the *presence* and *form* of the enamel-organ itself. One will, nevertheless, be tempted to believe," he continues, "that the nature of the future tooth is under the control of the dentine-papilla, a kind of organic mould upon which the calcific elements are grouped; but it must be remembered that the epithelial cord which represents the future enamel-organ always precedes the appearance of the dentine-papilla, which never originates till the cord has advanced a certain distance in its course. Accordingly, we believe that the epithelial cord decides not only the *place of genesis*, but the form and function of the corresponding tooth."

From the above quotation it will be seen that Dr. Magitot dissents from the general opinion in regard to the influence which these parts (namely, the enamel-organ and the dentine-germ) exercise upon each other.

As for myself, I had supposed that the enamel-organ was the more *passive* structure, and that its *form*, at least, was determined by the dentine-papilla.

I was strengthened in this belief by the generally recognized fact that the epithelial cord, from which the enamel-organ of the *temporary molar* is produced, is the same epithelial cord that produces the enamel-organ of the *permanent bicuspid* tooth. In this case, as is generally admitted, we have two enamel-organs eman-

ating from one and the same epithelial cord. Now, the forms of these two teeth, which originate from the same cord, are entirely *dissimilar*, the former being a molar and the latter a bicuspid. Thus originating from the same source, one would suppose that both of these teeth would have the same configuration, *if* the *form* were under the control of the epithelial cord or enamel-organ.

It is doubtless true, as Dr. Magitot has stated, that the formation of the enamel-organ precedes that of the dentine-germ. Yet it is equally true that, *until* the dentine-germ makes its appearance, the enamel-organ maintains nearly a spherical form, and the portion that is presented toward the developing papilla is *convex* instead of concave. The cap-form which it afterward assumes, must, one would suppose, result from contact with the developing papilla. From this it would appear that not only the *form* of the enamel-organ must be determined by the papilla, but also that the epithelial cells are increased in size, and modified in their character, by their contact with the dentine-germ. We find the cells, which are to compose the external and the internal epithelium of the enamel-organ, *alike* until the latter are brought into contact with the papilla; but their nature then undergoes a marked change, and this change, in the prismatic or columnar cells extends only to those that come into immediate contact with the papilla. We find, moreover, that the epithelial cells, from which the enamel and the hair are developed, are precisely the same histological elements until one is affected by contact with the developing dentine-papilla, and the other by that of the hair-papilla. These facts, if admitted, seem to favor the view that the dentine-papilla, rather than the enamel-organ, exercises an influence upon or determines the *form* of the future tooth.

But, in considering this subject more carefully, and examining both sides of the question, I discover evidence which strongly confirms the theory of Dr. Magitot. My conclusions rest mainly upon the statement of Dursy, who, according to Waldeyer, says that "the first germ of dentine appears in the dental *saculus*, as a dark, semi-lunar area at the bottom of the dental groove,—that is to say, of the enamel-germ,— cöetaneously and continuously, with which it is developed along each half of the jaw. At certain points, corresponding to the position of the subsequent teeth, the young structure develops in the form of papillæ, projecting against the

enamel-germs, while the remainder atrophies. The two horns of the semi-lunar mass (as seen in section) extend from the base of the dental papilla some distance upward, and embrace the dentine-germ and enamel-organ."

The particular point in this statement of Dursy to which I wish to call your special attention is that referring to *the semi-lunar area* of tissue extending along each half of the jaw, and from which the dentine-germs are developed.

If the anatomical description of Dursy is true (and I am not aware that it is disputed), it solves a question which has heretofore given me much difficulty, namely, *how* the enamel-organ and the dentine-germ, originating in distant tissues, never fail to meet each other.

Admitting this statement of Dursy,— that a membranous sheet extends along each half of the jaw,— this difficulty vanishes; for the enamel-organ cannot fail to come in contact with some point of this area in its descent in the embryonal tissue, and the fecundating influence of the enamel-organ would result in the development of a dentine-germ at this point of contact.

Now, according to this theory, a dentine-germ may be developed from any point of this semi-lunar area which may be reached by the enamel-organ. No *particular* point is assigned to the development of any *especial* dentine-germ: that is entirely accidental, and depends upon the course which the enamel-organ takes.

For example: If the epithelial cord of a cuspid should deviate from its normal course so as to come in contact with this *dentinal sheet of tissue* at a point between the bicuspids, the cuspid would be developed between the two teeth. In fact, whatever point in this tissue the enamel-organ of the cuspid should reach, the future tooth would be a true cuspid.

If this be admitted, the theory of Dr. Magitot must be true,— that the *enamel-organ determines* the *form* and *character of the future tooth.*

If the fact that the teeth of certain fishes are wholly destitute of enamel *seems* to militate against this theory, we have the statement from high authority that all teeth, whether clothed with enamel or not, are, in the formative stage, universally endowed with enamel-organs.

May we not *infer*, then, that in such cases the rudimentary

enamel-organ has performed its functions when it has *incited* the development of the dentine-germ, and determined its future *form* and *character?*

I throw out these suggestions for your consideration. If they have no other value, they may stimulate to investigations in this direction, which may lead to the discovery of *truth.*

In the foregoing I have endeavored to give, in a very brief manner, the present status of a few interesting physiological questions, without fully discussing or elaborating them, or presuming to decide the points in dispute, and, I fear, without offering much that will tend to their solution.

DISCUSSIONS.

Dr. Atkinson: I am almost inclined to go back upon my idea of making "Sections" of this Association, when I know that a committee has sent its representative here with such a report as the one we have just listened to. The only criticism I have to make is that it does not belong to the field of physiology in the ordinary acceptation of that term, but to the field of histology, which latter must always be understood before we can *truly know* anything about the former. The late discoveries in this very direction (a synopsis of which I hope to present to this body during its session) will teach us something entirely new concerning the formation of enamel. This discovery was made by Dr. Bödecker, one of the pupils of Carl Heitzman, during the last three months, and will explain very much of the ambiguity and disagreement which prevails with regard to this "epithelial cord."

I shall be able to show, from drawings which will place clearly before your eyes, the precise process which is referred to in the question, "What does give the form to the tooth?" And also to show you that it is the necessary typal bond of any physical body that gives us morphology of any living structure at all, and assert that every tooth sac has two distinct departments of its structure, denominated enamel-organ and dentinal-organ.

When the prospective uses of the tooth demand enamel, they call into exercise the proliferating power of, not "cells," but "embryonal corpuscles" — not worthy to be called *cells* in any sense;

and we wish to wipe out the term "cell" (that stumbling-block which has lain in the way ever since Virchow took the lead in histological research in Germany), to enable us to discover that when the tooth which is being built requires the type of enamel, there will be enough embryonal corpuscles converted into enamel membrane to take on lime salts that may be calcified; but I will not detain you to explain, as I shall hereafter show you the drawings. This will deliver us from the abominable nonsense of ignoring the POWER by which we all live, and enable us to see clearly that there is something before that constitutes type, and orders the elements of tissues to be placed in proper position. As to the idea of these membranes finding each other — they do not find each other any more than billiard balls find each other after you have struck them with the cue. The energy behind sends them to their destined position, according to the skill of the manipulator, and by that is the game determined.

I hope, in a very few years, if not months, we shall be able to see that what has been called "epithelium" is also a stumbling-block in our way; that we have called epithelial bodies by too many different names; that we have called simple "embryonal corpuscles" (the first differentiation of the protoplasmic mass, under the type of the organism of whatever kind it may be); we have called these "*epithelial*" *bodies*, when they are nothing but colloid masses, mere little lumps of jelly, that hold within them the potentiality or possibility of being wrought into the special kind of tissue that the type demands. It would be a very slight step to go from this report into Embryology, for all reproductions follow the laws of primary production in every instance, and all reproduction that we know anything about is embryological in its character.

Report on Physiology.

By J. H. McQUILLEN, of the Committee.

Recovery of all the Faculties in a Pigeon from which Four-Fifths of the Upper Portion of the Cerebrum had been Removed.

MONDAY, February 5, 1878, in illustration of my regular course of lectures on physiology, in the Philadelphia Dental College, I exposed the cerebrum of a pigeon, as I have regularly done each session for the past twenty years, and cut out four-fifths of the upper portion in slices, to illustrate the fact that the sensorium thus exposed could be cut, pinched or burned without any manifestation of suffering on the part of the animal. The usual phenomena attendant upon the operation followed — *i. e.* profound stupor, the bird standing motionless on the table, with eyes closed, the head sunk between the shoulders, and the feathers ruffled; when pushed, it opened its eyes and moved the body, and when thrown into the air it flew a few feet, and then, on alighting, relapsed into somnolency, with an evident obliviousness to surrounding objects, until again aroused by handling. In this condition, along with another pigeon, from which the cerebellum had been removed, it was shown to the members of the biological and microscopical section of the Academy of Natural Sciences, on the evening of that day, at the regular monthly meeting of the section. Prof. Frances Emily White, M.D., professor of physiology in the Woman's Medical College, who was present, having manifested much interest in the pigeons, I offered to send them to the Woman's College, so that she could show them to the students, with the request that an effort should be made to keep them alive, and ascertain whether the functions of the cerebrum and cerebellum would be restored. Other duties of an absorbing character so occupied my time and

attention, that I had quite forgotten the request made by me until February 28, when a note was received from Prof. White, stating that "The pigeon from which the cerebrum was partially removed seems to have recovered all his faculties. He is, perhaps, less excitable than normal; seems particularly tame, but bright. . . . The other pigeon died on the third day after the removal of the cerebellum."

I at once sent for the pigeon, and was surprised at the complete recovery of the voluntary movements of walking and flying, the general manifestation of intelligence, and the fact of feeding itself and drinking as usual. There could be no question about the identity of the pigeon, as it was of a peculiar breed, and the cicatrix on the neck, where the incision had been made, so as to throw the scalp back and expose the cranium, along with a soft place in the latter, from which a portion of bone had been removed, left no doubt on that point. I again exhibited it at the monthly meeting of the Biological and Microscopical Section, March 4, and the members were surprised to find it fly about from one end of a long room and back again, feed itself, etc.

I asked them, and I repeat now the same question, How are we to account for the restoration of these functions? Is it due to the fact that the small portion of the cerebrum left after the operation assumed the functions of the entire organ, or has there been a regeneration of the part removed? Vulpian, one of the most accurate and reliable of the recent experimentalists and observers of these phenomena, positively asserts that an animal from which the cerebral hemisphere has been removed is incapable of a spontaneous voluntary movement. In this he is apparently supported by every observer, with only one exception, Voigt.

The latest author, in writing on this subject, M. Foster* (whose views may be regarded as summarizing those generally entertained), says: "When the cerebral hemispheres are removed from a bird, the animal is able to maintain a completely normal posture, and that, too, when the corpus striata and optic thalami are taken away at the same time. It will balance itself on one leg, after the fashion of a bird which in a natural way has gone to sleep. In fact, the appearance and behavior of a bird which has been de-

* "A Text-book of Physiology," by M. Foster, M.A., M.D., F.R.S. London: Macmillan & Co., 1878.

prived of its cerebral hemispheres are strikingly similar to those of a bird sleepy and stupid. Left alone in perfect quiet, it will remain impassive and motionless for a long, it may be for an almost indefinite, time. When stirred, it moves, and then on being left alone, returns to a natural easy position. Placed on its side or on its back, it will regain its feet; thrown into the air, it flies with considerable precision for some distance before it returns to rest. It frequently tucks its head under its wings; and if by judicious feeding it has been kept alive for some time after the operation, it may be seen to clean its feathers, and to pick up corn or drink water presented to its beak.* It may be induced to move, not only by ordinary stimuli applied to the skin, but also by sudden sharp sounds, or flashes of light; and it is evident that its movements are to a certain extent guided by visual sensations, for in its flight it will, though imperfectly, avoid obstacles. *Save that all signs of volition are absent;* that the movements are, on the whole, clumsy, resembling rather those of a stupid, drowsy bird than those of one quite wide awake, there is very little to distinguish such a bird from one in full possession of its cerebral hemispheres."

There is but one other case on record that I have met with, where there has been a recovery of voluntary action on the part of a pigeon from which the cerebral hemispheres had been removed. And I was not aware of that fact until the experience with my pigeon induced me to make a careful examination of the literature of the subject. I refer to the pigeon "kept alive for five months after the cerebral lobes had been, as stated by Voigt, *completely removed.* At first the pigeon presented the phenomena usually observed after this operation; but it gradually recovered, until it seemed entirely normal, with the single exception that it never would eat, all food being introduced forcibly. Five months after the operation the pigeon was killed, and the encephalic cavity was found filled with a white substance containing dark-bordered nerve-fibers and nerve-cells. Voigt never before observed anything like regeneration of the nervous substance, or so complete a restoration of the cerebral functions, and he regarded this as an

* Bischoff and Voigt, Sitzungsberichte Acad. Wiss., Munchen, 1863, pp. 479-469; 1868, page 105.

instance of anatomical and physiological regeneration of the hemispheres." Flint,* from whom this extract has been taken, goes on to say: "The objections to accepting this observation, with the conclusions presented by Voigt, are, that it is not only possible, but probable, that the hemispheres were not entirely removed, and that the posterior portion of the encephalon had advanced to occupy in part the space originally filled by the extirpated mass. While we do not assume that anatomical and functional regeneration of the cerebrum in a pigeon is impossible, it must be admitted that such an extraordinary statement as that made by Voigt cannot be accepted without reserve, merely upon the basis of a single observation."

In contrast to this case, it must be remembered that I only removed the upper four-fifths of the cerebrum. In doing this, however, the superficial gray matter of the hemispheres, recognized as the structure physiologically concerned in the exercise of the faculties of attention, perception, memory and will, was removed.

The pigeon continued in the full possession of its faculties for six months, when, in the presence of several scientific friends, it was put to death under chloroform, and a *post-mortem* examination made. On removing the scalp, a fibrous structure, analogous to the pericranium, was found occupying the place from which the bone had been taken in making the vivisection. Cutting this away, a small amount of fluid escaped, and the cranial cavity was found occupied by a white substance resembling the cerebral structure that had been removed six months before. Placing a section of this, stained with hematoxylin, under the microscope, a number of bi-polar cells, characteristic of the gray structure of the brain, were observed.

That the bird should have survived such an operation and lived for six months after, in the full possession of its faculties, is a remarkable illustration of the recuperative powers of the system. And the regeneration of the parts removed is evidence in substantiation of the case reported by Voigt. Those who may doubt these two independent cases, because they are something new and out of the usual order, should try the experiment, and observe

* "Human Physiology," by Austin Flint, Jr., M.D. New York: D. Appleton & Co., 1876, page 699.

whether they cannot obtain the same result, before calling into question the accuracy of these observations.

As Brown-Séquard, the successor to the chair of physiology vacated by the death of Claude Bernard, has justly observed, there is much to learn and unlearn with regard to the nervous system. Many of the conclusions formerly arrived at and regarded as correct beyond a question of doubt, have been proved by him to be erroneous, and a field is thus opened for investigation. Notwithstanding the anathemas against vivisections, this is the only way in which the truth can be obtained.

NOTE.—Since the above report was presented to the American Dental Association I desired the Biological and Microscopical section of the Academy of Natural Science of Philadelphia to appoint a committee to examine the pigeon's brain. The following is the report presented by the chairman of the committee, Dr. Carl Seiler:

"The specimen handed to me by Dr. J. H. McQuillen appeared to be the medulla, cerebellum, and part of the cerebrum of a bird. Intimately connected with the parts were two tumor-like growths, the one spherical and of the size of a pea, the other of irregular outline and smaller than the first. A microscopical examination of these growths revealed them to be composed of nerve-tissue, showing longitudinal and transverse sections of nerve-fibres, and in some places multipolar ganglionic cells. The blood-vessels, which in the round growth appeared to radiate from a common centre at the base of the growth, were filled with oval blood-disks."

This report was accompanied by sections of the pigeon's brain, showing under the microscope (and along with microphotographs of the same) multipolar nerve-cells, prepared by Dr. Carl Seiler.

REPORT OF COMMITTEE

ON

HISTOLOGY AND MICROSCOPY.

By G. V. BLACK, Chairman.

THE ODONTOBLASTS.

THE author of this report, in some remarks before the Illinois State Dental Society, of last year, showed the practical bearing that an intimate knowledge of the nature and functions of the odontoblasts might have on the treatment of exposures of the dental pulp. Since then the subject has engaged the attention of many observers, and has become one of peculiar interest to the dental practitioner. Heretofore these elements seem to have been studied only by a few, who were more especially interested in scientific research, but this phase of dental knowledge was not much sought by the masses of even the best practical operators.

Charles Tomes has recently written an article in which he reiterates what we said a year before, in almost the same words. Thus suddenly, as it were, this layer of cells — their physiological significance, their generation, regeneration or non-regeneration, their pathology, destruction, or the means of continuing their vitality when their life is threatened,— all have become questions of the utmost significance to every practical dentist who would be fully prepared to treat, in the wisest manner, the cases that come into his hands.

The questions which have been discussed, and may be said to have been definitely settled, are very few indeed; while those that are as yet unsettled are many, some of which are of the gravest import to the practitioner.

Our definite knowledge of the subject may be stated as follows:

The odontoblasts form one distinct layer of cylindrical cells, placed compactly side by side, covering the entire pulp surface, each of which cells sends one or more processes into the substance of the dentine, occupying the dentinal tubes. It is an admitted fact that the odontoblasts are the active agents in the formation of the dentine, and that no true dentine can be formed without them. The precise manner in which the formation takes place is a matter of discussion.

The exact shape of the odontoblasts, before post-mortem change, cannot be definitely determined from the study of the writings at our command; and the settlement of this question presents no inconsiderable difficulty, on account of the very radical differences of form presented to the observer. These shapes, as we have personally observed them, and as they have been described by others, are: 1st, A round body, three to five times as long as broad, with the pulpal end smoothly rounded or inclined to be pointed: the dentinal end distinctly fusiform for one half or more of the length of the cell, giving rise to a long, slender process — the dentinal process, or dentinal fibril. Lateral processes are also observed, given off from the cells at right angles, or nearly so, to the principal process. 2d, Pulpal end same as first form, dentinal end abruptly squared and inclined to be ragged, while the whole length of the cell is continued of one size.

Among either of these forms of cells may be found those which present pulpal processes also, to which we will allude farther on. The cells of the fully-developed tooth also present some variations of form which have been considered as a mark of the inactivity of the cell. In all these forms there is an oval nucleus, which is usually much nearer the pulpal extremity of the cell, and, in the first form, always corresponds in position with the largest diameter of the cell.

These are the forms presented to the observer. The correct determination of these, and from them deducing the true living form, is of importance; for upon the determination of this hangs, in no small degree, the determination of some other questions. For instance, if the square, ragged dentinal end be accepted as the true living form, there is nothing in it to prevent us accepting the theory of calcification presented by Tomes, for this form of the cell favors that theory. If, on the other hand, the fusiform den-

tinal end be accepted as the true living form, it furnishes a very powerful argument against that theory; such, indeed, as will necessarily, we think, lead to its abandonment, for the form of the growing surface of the dentine will in no wise correspond to the surface presented by the cells.

This question of *form* is of such importance that we will give our observations at some length. Form No. 1: The fusiform dentinal end of the cell may be demonstrated by taking a growing tooth, fresh from the mouth, with a wide, open root; drag the pulp away; a large number of the odontoblasts will be left clinging to the dentine by their fibrils; with a delicate blade these may be raised off in flakes, drawing out with them the fibrils, sometimes to considerable length. When these are examined in an indifferent medium, they will be found of the shape above described. They may be stained with carmine, or treated with acetic acid, for the better showing of the nucleus without material change of form; but they must not be subjected to the action of an acid, nor to any of the ordinary hardening processes, before being removed from the tooth — certainly not before the removal of the pulp — otherwise they will be found of the second form described, having square dentinal ends.

We have found the squared dentinal end always presented in those sections where acid reagents had been used for any purpose previous to the cutting of sections: hence in all such sections we meet with this form of the cell, which we suppose to have been the case with other observers. In this case the cell is of nearly uniform size throughout its length. We have in our possession some sections of the teeth of the common garter snake, cut diagonally across, in which the undisturbed ends of the odontoblasts may be seen lying squarely against the dentine and their fibrils projecting into it. There seems to have been just enough shrinkage for the outlines of each cell to be plainly distinguished, or there is an intercellular substance that takes a darker stain with carmine. We incline to the former view, for the reason, if nothing else, that if such intercellular substance existed it would probably take a lighter stain.

None of these forms are original with us, they have been observed and figured by others; but their relations and significance seem not to have been discussed. It is a significant fact that

throughout our researches the fusiform dentinal end has always presented itself when we have used the perfectly fresh specimen without the use of acid reagents or hardening processes, and that the squared dentinal end has as uniformly presented itself when we have used acids or other hardening processes.

This would seem to argue, in the strongest manner, that the fusiform dentinal end is the normal living form, and that the squared dentinal end is the result of post-mortem change. But for the fact that other observers of eminent ability, in whose judgment we place great confidence, have considered the squared end as the true form, we should undoubtedly have accepted the fusiform end as the true form without question. What could bring about the change in either case? These can be neither normal nor abnormal differences, but must be post-mortem differences. We have repeatedly observed both of these forms in the same individual. We have been unable to imagine any force that could be brought to bear to change the squared end into the fusiform end. Then what has changed the fusiform into the squared end? We have imagined that it might be the coagulation of a substance that existed between the cells and the dentine or among the fusiform ends of the cells. If this were true, it seems a little remarkable that this coagulated material should so grasp the cells as to continue their size and at the same time show no trace of its junction with the cell, even under carmine-staining. We have looked in vain for this mark that would prove coagulation. The continuance of the size of the cell seems to belong to the cell itself. A second possible cause for this transformation is in the flattening of the ends of the cells against the dentine by the forcible expansion of the tissues of the pulp by the acid reagent, and their becoming *fixed* in this form. It is well known how susceptible these or any other similar cells are to change of form under pressure. My observations on this point would seem to show that the cell in the one case *is longer* than in the other. Yet this change of form has occurred when I had thought the conditions were such as to allow of the free expansion of the pulp. And still again we have found this form of the cell in young teeth that we have cut without the aid of the decalcifying process. In these, means were employed for hardening which caused more or less shrinkage, and close scrutiny showed conclusively that the tissues of the young

pulp had been impacted into the dentine-cap, and that the tissues of the neighborhood were more or less drawn in after them, and the odontoblasts toward the brim of the dentine-cap forced more or less toward the apex, in such a manner that the dentinal process was bent twice at right angles before entering the dentine, or broken off altogether. Now, if we will remember that these cells are composed of semi-solid protoplasm, we can understand how their dentinal ends may become flattened against the dentine and their whole form changed. Farther on we will speak of the bearing of these different forms on dentine-formation.

We will now speak of the pulpal end of the cells. There are apparently two forms,—the rounded end, or inclined to be pointed, and the end armed with a pulpal process. The rounded end is most generally observed when the cells are separated from the pulp, but among these we occasionally notice a few presenting processes. These, we think, present less difficulty. We believe the real form to be the rounded end, and that these cells end just the same as do those columnar cells of specialized function, the ends of which are fixed to a basement membrane. Except that here there being no such membrane, they are fixed to the extended processes of the adjacent connective tissue cells. It is well known that, in case there is a membrane to which such cells are affixed, little cups or shallow alveoli are formed which receive the ends of the cells, as may be demonstrated in case of the ameloblasts,* and is fairly made out in some other positions. Now, the fact of there being no membrane in this case does not change the order, which is pretty distinct separation of cells of specialized function from indifferent tissues. The ends of the cells are still received into shallow alveoli formed by the expanded ends of two or more processes of the adjacent connective tissue cells. In this view of the case, which we deem sufficiently simple, the appearance of pulpal processes in the separated cells is the result of tearing off the process from the connective tissue cells, instead of stripping them from the end of the odontoblast. The appearance of these processes in sections explains itself.

As has been said, the odontoblasts are admitted to be the active

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* AMELOBLAST, from AMEL, the old Saxon word for *Enamel*, and BLAST, from the Greek *Blastos*, a germ, is here used to denote the formative cells of the enamel corresponding with Osteoblast, Odontoblast, etc.

agents in the formation of the dentine. The precise manner in which this formation takes place is a matter of discussion, several theories being held by different observers:

1st. That the dentine is the direct result of the deposit of lime-salts in the odontoblasts themselves, which lengthen in proportion as they are calcified, or grow at the pulpal end, while the dentinal end is being converted into dentine, the cell retaining its original form (Tomes).

2d. That the odontoblasts are calcified as above, but that the intertubular substance results from the calcification of a secretion from the odontoblasts.

3d. That the dentine is the calcified secretion from the odontoblasts, which are not themselves calcified.

4th. That the dentine is the result of the calcification of the product of the melting down of the dentinal ends of the odontoblasts, which are themselves renewed by the formation of new cells in the contiguous portions of the pulp and their attachment to the older cells.

It is no part of our intention to present a theoretic discussion of these views of calcification, though grave objections may be urged to any or all of these views. Either of them makes the presence of the odontoblasts, in healthy function, necessary to the formation of normal dentine; therefore the destruction or impairment of the function of the odontoblastic layer prohibits the further formation of dentine until the conditions of health are restored.

The bearing of these expressions of the formation of the dentine is of much practical import; for if one cell continue in length from periphery to center of the dentine-formation, its dentinal end calcifying, and the pulpal end growing, then we have necessarily but one generation of odontoblasts, in which case we cannot reasonably suppose that provision is made for their reformation when destroyed by accident or disease.

On the other hand, if the cells form the material to be calcified, but do not themselves calcify, theoretically there would seem to be more opportunity for the bridging of small gaps by the lateral proliferation of cells; for in this case there is certainly less intense specialization of the cell than in case of individual calcification. Certainly a cell that is formed for the especial purpose of, in itself,

forming another and distinct tissue, by receiving into itself the material of that tissue as rapidly as it is itself formed, is the most highly specialized cell we can imagine. While it is possible that such a cell may have the power of proliferating its kind in the very early stages of its existence, before the real work to which it is destined is begun, we should expect that such power would not be continued in connection with the active performance of that function in which its character is so entirely changed. It is, however, a matter of the gravest doubt whether a specialized cell, in the active performance of its special function, has at the same time the power also of propagating its kind by any manner of cell-genesis. The careful study of cell-life will, we think, support this view. Our own observations, also those of other observers, seem to give the most positive proof that there is no such thing as the lineal regeneration of the odontoblasts, as held by Waldeyer and others. They present but a single layer, which, when the section is cut parallel to their length, is clear and decisive in all cases, and forming cells at their pulpal ends are never seen. All such appearances are the result of oblique section.

Our observations have furnished no example that we think can fairly be interpreted as furnishing proof of the lateral proliferation of the odontoblasts after the first beginning of the act of calcification. Nor have we seen the evidences of this in the facts detailed by others. We have been mindful of the value of a definite settlement of this question in its practical bearings on the treatment of exposures of the pulp, and have bent our energies to the discovery of facts indicating the multiplication of these cells, but so far in vain. We have indeed discovered cells presenting two nuclei plainly and distinctly,—which fact has also been noticed by others, and has been interpreted as furnishing evidence of multiplication by fission. We deem this a grave error, for the following reasons: When we examine the dentine we find it permeated by a multitude of dentinal tubes, which present bifurcations as we proceed from the pulp to the periphery. These we know have not grown from pulp to periphery, and branched out like a tree, but have grown from the periphery toward the center, and have coalesced. Now, in the beginning of the growth at the periphery, each odontoblast, with a few possible exceptions, was united to a single principal fibril. These odontoblasts are closely packed together at the periphery,

and as the surface of the pulp is lessened by the approach to the center, the number of odontoblasts is necessarily diminished. Their fibrils do not end blindly, as if the cells had simply disappeared, but we find that these fibrils have coalesced with others, constituting thereafter a single fibril.

Now, this union of the fibrils, or processes of different cells, we interpret to mean, also, that the two cells to which they have belonged have coalesced first, and become one cell; at first, with two nuclei, but very soon with but one; at first, with two fibrils also, but very soon with but one.

This view of the case, which is well supported by observed facts, shows the manner of the diminution of the number of the cells, but utterly fails to give any encouragement as to the regeneration of lost cells.

Now, if we go back and study closely the cells of the pulp just before and while the odontoblasts are forming, we think one cannot fail to conclude that the latter are specialized from the superficial cells of the former, without any such thing occurring, even here, as lateral proliferation. Sections prepared by us seem to show the following facts: In an early stage of the development of the pulp the ends of the ameloblasts are applied directly to its surface, to which they seem to be very loosely attached, though sufficiently so to cause some stretching of the tissues in pulling them apart, as we have often observed under the dissecting microscope.

Just before the commencement of calcification, and even before the odontoblasts make their appearance, the ameloblasts and the tissues of the pulp are separated by a well marked double pellucid layer, which in section appears as a double band, belonging about equally to the enamel side and to the dentine side of the very distinct line of demarkation between what is to become these two tissues. By careful ammonia-carmine staining this pellucid double border is brought very clearly and sharply into view, as it does not take the color. Its real width is not easily determined, for the reason that it is subject to variations by the handling of the sections. It is clearly jelly-like, and may be stretched widely, or so crushed together as to disappear entirely. This nature of the material is well illustrated in some of our sections, in which the double band is partially separated; the two parts hanging together

by points of more or less width, not separated, but very much drawn out. Now, lying more or less out into this pellucid band or layer of the pulp, a layer of cells may be seen, not differing at first from neighboring cells. Upon these, by careful work with a good power of six or eight hundred diameters, delicate processes may be seen pointing out into the clear band directly toward the junction or line of demarkation between the future dentine and enamel. As the point of calcification is approached, these cells are rapidly enlarged, for a time maintaining a somewhat rounded form, but soon stretching out into the form of the odontoblast. And as soon as the full form has been attained, we find that calcification has begun.

Now, if these observations are correct, they would seem to show that all the odontoblasts are formed by differentiation from the cells of the pulp, and enter at once on the performance of their special function. In this case, if the before-mentioned theory as to cell-genesis be correct, there is no such thing as the lateral proliferation of odontoblasts at any time. The odontoblasts are developed partially within the pellucid zone; that is, it reaches back a little more than one-half their length, inclosing their attenuated dentinal ends. As to whether this condition is maintained throughout the progress of calcification, cannot be proven or disproven by our present means of research, on account of the changes before alluded to in the form of the odontoblasts, in which case the pellucid stratum does not appear.

Whether this disappearance is the result of the means employed for obtaining the sections, or whether it is really only a temporary condition, must for the present remain a conjecture.

Examinations of secondary formations of dentine afford us the only opportunity of positively determining that the odontoblasts have been reformed after having been once destroyed. This demonstration will require that the pulp of the tooth be exposed over a sufficient space for observation, and the surface of the organ destroyed in such manner as to prevent the possibility of the odontoblastic layer having escaped destruction. This must then be capped with suitable material, or treated in any appropriate way, and allowed to remain a sufficient length of time, or until the gap is found closed with calcified material. The tooth must then be removed and sections made through the new deposit

and examined for dentinal tubes. If these present themselves in such form as to leave no doubt as to their being true dentinal tubules, the regeneration of the odontoblasts will be proven. So far we have no sufficiently accurate knowledge of this having been done. True dentine of secondary growth has been found in many instances, demonstrating that cells which have ceased to be active may reassume the active state. This may occur without, or with, exposure of the pulp, under the condition of excitement occasioned by abrasion or other influence. But we cannot assume that because there has been an exposure of the pulp the odontoblasts have been destroyed. To be sure of this, we must see that the surface of the organ has been destroyed, and this beyond the possibility of a doubt.

We have collected a considerable number of secondary deposits that have been found blocking up exposures of the pulp, in which more or less inflammation had been known to have existed; and it has been our misfortune thus far not to have found one of these that could be regarded as a physiological formation; while the majority of them are not dentine at all, but a mass composed of united calcospherites, or an infiltration, apparently of lime salts, into the indifferent tissue of the pulp, either of which we must regard as pathological formations. In some cases we have found a portion of the mass formed of true dentinal tissue, which has usually corresponded with the more central part of the exposure, with either a clear indifferent calcification or calcospherites at the margins, and a failure of continuity with the margins of the exposure.

This has happened in many cases in which, before making the sections, we supposed the fusion was perfect. Some of these cases are very interesting. Some, which we have found blocking up this class of exposure, show in their central parts some very well formed dentine, although irregular, while others are very nearly perfect dentine until the margin of the exposure is almost reached, and is bordered by a margin of calcospherites, and complete failure of fusion with the margins of the exposure exists. In two instances we have found perfect fusion with the margins, with a continuation of tubules from the pre-existing dentine into the new at one or two points, while fusion failed around the principal portion of the margins. Such points have been determined by fre-

quent examinations with the microscope during the progress of the grinding.

We should judge from the appearance of these formations that the inflammation that had existed had caused swelling of the pulp, which caused it to protrude slightly through the breach in the dentine, the sharp margins of which have wounded the pulp, possibly caused slight ulceration, thus destroying a circle of the odontoblasts of more or less extent, and that the cells thus destroyed have never been reformed; hence the failure of fusion between the new and the old formations, aptly illustrating the inability of the odontoblasts to bridge a gap of even less than the one-hundredth of an inch by lateral proliferation.

The question naturally arises, in this connection, as to whether the odontoblast may not be differentiated or reformed from the cells of the pulp. This is evidently the source from which we should expect their reformation, but the number of cases which we have examined in which this has not taken place, where the conditions would seem to have been favorable for such reformation, certainly shows that we need not expect it in very many instances. We have never seen but one instance in which such a result seemed to be illustrated, and that we will give presently for what it is worth.

We have seen some cases in which the pulp had been covered in for from eight to ten years, remaining apparently healthy, in which considerable calcifications had taken place without a trace of true dentine,— but finally these pulps had died.

Certainly it seems that, in cases where the pulp had remained so long in apparent health, a new layer of odontoblasts would have been formed, if we have a right to expect them in any case, yet such reformations did not take place. These deposits seem to be the result of an effort of the tissues of the pulp to vicariously reform parts to fill a breach in the integrity of the tissues, in the absence of the true dentine forming cells.

Still we cannot regard such reformations of the cells from the adjacent tissues as impossible, and we have found one case which seems to us to illustrate such reformation. The specimen is altogether a novel one. The new formation was $\frac{14}{100}$ of an inch in length, about $\frac{8}{100}$ of an inch in breadth, and $\frac{7}{100}$ of an inch in thickness. It was continuous with the margins of the exposure at

one point, the tubes of the old continuing into the new. At all other points there was entire failure of union, as was determined during the grinding. Many parts of the new tissue were clear, presenting no tubules whatever, but at intervals there were tufts of very fine tubes, which concentrate and coalesce into one, forming a true dentinal tube a little larger than the ordinary, which pursues a tortuous course in a centric direction, as far as can be traced in the section which is not cut just parallel with their course. These tubules seem to have their origin within the newly formed tissue, not immediately at its peripheral margin. If this be accepted as a fact, then the specialization of odontoblasts from the cells of the pulp in adult life may be considered as demonstrated. If these had had their origin from the primary odontoblasts the tubes certainly would not have arisen in the midst of the newly formed tissue, but near its peripheral margin.

Furthermore, on examination of the walls of the pulp chamber, there appear evidences of the destruction of the odontoblasts of the region, in that the tubules end abruptly, over the ends of which a clear material seems to have been deposited. At one point a large calcospherite appears in section fused into the wall. At one point in this clear margin there also appear a few of the same tufts seen in the new formation.

The case is one that had been left to nature. The patient gave a history of repeated and severe toothache, for the most part occurring three and four years previously. At the time we saw it the pulp was in a dying condition. Of course too much stress must not be laid upon a single case, and future examples may possibly suggest other explanations.

All are acquainted with those calcific deposits familiarly known as nodules. We have been in the habit of making sections of these in search of dentinal tubes, but never have been so fortunate as to find them. We believe such to have been reported by others, but we have no sufficiently definite history of them to justify us in reporting them as demonstrated. If such are found which have been formed within the odontoblastic layer, it would seem to us that the odontoblasts had been developed from the cells of the pulp in a secondary way. Yet even here there is a doubt, for the reason that some observers have reported the finding of such nodules in the pulps of developing teeth, which leads to the suspicion that

those which may show such nodules may have had their origin from cells developed at the time of the original development of the odontoblasts. We have examined the pulps of a goodly number of developing human teeth, but have never discovered such nodules among them.

WEDL states that excrescences are found on the walls of the dentine, or between it and the odontoblastic layer, which do present dentinal tubes. These, he says, may be either attached to the dentinal wall or not. We can conceive that such might occur from any disturbing cause that would throw this layer into a fold or detach the fibrils from the dentine, but how such disturbance could be brought about is the question. Yet as we have seen instances in which the odontoblastic layer seemed to have been destroyed around a portion of the surface of the pulp and comparative health of the organ resumed, we may suppose it possible that their connection with the dentine might be severed and the cells retain their vitality, and a new deposit, in the form of an excrescence, result.

From the foregoing facts it would seem evident that the reformation of the odontoblasts, if it occurs at all, is a matter of great difficulty, and can only be expected in cases of the most favorable kind. We certainly cannot expect it to occur, as a rule, from organs whose functions have become impaired from severe inflammation, or long continued irritation. Neither can we expect it from pulp surfaces that have healed by granulation, for it is not probable that we would obtain a differentiation of cells of special function from cicatricial tissue.

REPORT ON HISTOLOGY AND MICROSCOPY.

By C. N. PEIRCE, of the Committee.

THE MECHANICAL GENESIS OF TOOTH FORMS.

WE have received from Mr. John A. Ryder his paper upon the above subject, just published in the "Proceedings of the Academy of Natural Sciences of Philadelphia." In it there is so much of interest that is pertinent to the subject of dental histology, that I trust a *résumé* of the paper will prove acceptable to the association as a part of the report on Histology.

Some of the conclusions Mr. Ryder arrives at from his study of the osteology of the mammalia are as follows:

First. That in *Carnivora* and *Omnivora* the jaws were simply opened and closed during mastication without lateral movement of the mandible or lower jaw, and that the earliest and most constant type of tooth accompanied this movement; that is, that the tubercles or cusps composing the teeth do not to any extent depart from the short-rooted type with conical tubercles, styled by odontologists bunodont. That the distance apart of the series of molars of opposite sides, of both upper and lower series, was approximately alike; that is, that in closing the jaws the external or buccal cusps of the upper series were brought exactly upon a line with those of the lower, not over them, as is the case in all *Herbivora*, and to some extent in man. This condition he has styled isognathism.

Second. That in the *Herbivora* the jaws were opened and closed in mastication with extensive lateral movement of the mandible; and that the teeth were by this greatly modified in respect of their tubercular constitution, the tubercles being of the type known as crescentic, giving us the long-rooted selenodont type of tooth. That in these the width of the jaw, or the distance apart of the upper series of molars of opposite sides of the head, greatly exceeds the same measurement in the mandible, which results in the external or buccal cusps of the upper series closing over and external to the buccal cusps of the lower series. This condition he has styled anisognathism.

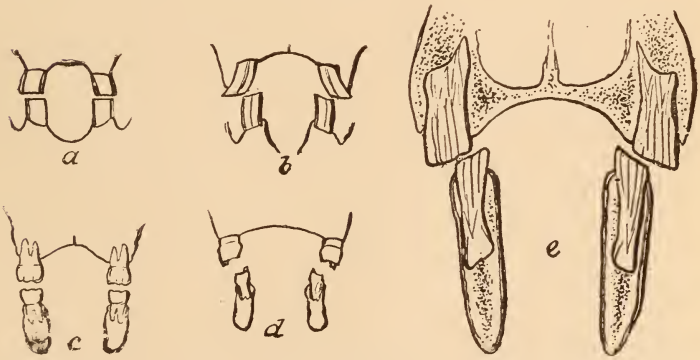
Third. That in some *Rodentia* and *Proboscidia* the mandibles were moved in a backward and forward, or antero-posterior, direction, which he has termed the reciprocating movement, with which there was also a corresponding tubercular modification, which he calls trichecodont,—three tubercles forming transverse ridges, frequently obsolete, or greatly flattened transverse lamella, composed of elongated and united tubercles soldered together by a thick cementum layer (Elephas). Isognathism is usually a characteristic of this subdivision.

Fourth. That in a subdivision including a part of *Rodentia* and *Proboscidia* (Mastodons), the movement of the mandible was both reciprocating and lateral, with a still more complex type of dentition as a result, which he has styled ptychodont,—enamel fluted and folded upon itself longitudinally and transversely. These jaws are usually anisognathous.

The foregoing groups Mr. Ryder has tabulated in the following manner:

1. No lateral movement (Omnivora)		Isognathous.
2. Lateral movement (Herbivora)		Anisognathous.
3. Reciprocating movement	Some Rodentia Some Proboscidia	Isognathous.
4. Lateral and reciprocating movement	Some Rodentia Some Proboscidia	Anisognathous.

Fig. 1



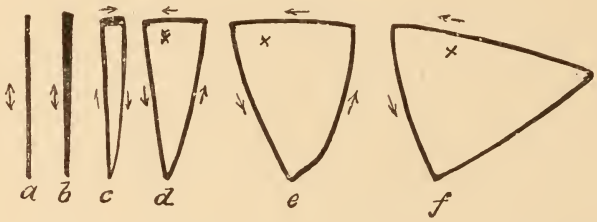
a and *c* represent, in transverse diameter. isognathism, *b*, *d* and *e* represent anisognathism.

These observations, based upon investigations made not only upon the skulls, but also upon the living animals, afford, he thinks,

the key whereby to correctly interpret the morphological history of the teeth of the higher groups, especially when brought to bear on the interpretation of the teeth of the great number of herbivorous remains which the rocks have yielded in recent times, as intermediate or antecedent forms.

The accompanying illustration is given as diagrammatically representing the figure described by the mandible, when in motion,

FIG. 2



of different varieties of animals. *a* is the figure described by the tip of the mandible of the *Carnivora* and *Omnivora*, represented by the dog and hog; *b*, a transition form, observed in the wart-hog; *c* is that described by the end of the mandible of the tapir and the kangaroo; *d* is a theoretical form, suggested for the extinct and intermediate horse; *e* is the figure peculiar to the rhinoceros, and *f*, that made by the giraffe and other ruminating animals.

The figure *a* belongs to and is characteristic of group 1, as defined above. The remaining figures, *b*, *c*, *d*, *e*, *f*, serve to characterize group 2. Groups 3 and 4 have not been illustrated, but can be easily and clearly conceived by reference to the definitions of the groups given.

The number of kinds of excursions made by the mandibular rami is limited by structural impediments, since a bar fixed at one end and free at the other, to which the mandible may be compared, is capable of but a few distinct movements. We find these to be essentially those mentioned in the definition of the four groups; few others are possible or conceivable. The first movement is the vibratory one in a vertical plane; the second is the vibratory movement in both the horizontal and vertical planes; the third is the vibration of the rami in an approximately horizontal plane, neither lateral nor vertical, but an antero-posterior or reciprocating movement, parallel to the medial axis or line; the

fourth is that which combines to a great extent the second and third. It is also to be observed that the lines described in most cases are not straight, but only approximately so, they being more or less curvilinear. With these four distinct types of mandibular movement there are as many distinct types of tooth-modification, to which almost all the forms of teeth of Mammalia yet known may be referred. The bunodont type is that characteristic of group 1, and in which the tubercles have not been modified, because there have been no movements of a proper kind to produce the modifications in the enamel foldings, as observed in the longitudinally or the transversely folded enamel crowns of the lophodonts (ridge or hill tooth). To this foregoing group 1 belong also all the haplodont types (simplest forms), as observed in the toothed whales.

According to the doctrine of mechanical dental differentiation, the foldings of the enamel in the teeth of groups 2, 3, and 4, whether they be longitudinal or transverse, are due either to the lateral or reciprocating movement of the jaws. The sub-group, selenodonts,— so called in consequence of the crescent-shaped foldings of the enamel of which the deer is a familiar example,— is perhaps the most striking illustration of all. The characteristic crescent-shaped tubercles, the author thinks, have probably been evolved by a very slow process of flattening and bending outwards or inwards of the cornu of the tubercles, due to the strains exerted in masticating the tough woody food. The movement in this case, being constantly in one direction, makes it still more probable that such has been the history of the process.

In a subsequent communication from the author, he says, "I have never yet been able to satisfy myself in regard to the direction of the motion of the ramus when the jaws are in contact, though it has occurred to me that it would make but little difference, since the obliquity of the crowns of both the upper and lower series in opposite directions would render it a matter of little consequence whether the movement were from within outwards or from without inwards, because in both cases the mechanical conditions necessary to effect the requisite differentiation would exist."

He says further, "It is, moreover, noteworthy that in no instance have I been able to discover that the plan of the enamel foldings of the teeth in any lophodont was such as not to agree with the direction and kind of mandibular movement."

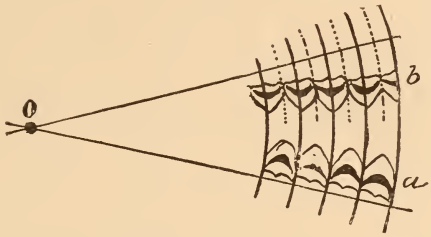
From the views advanced and the illustrations confirming them, which we have extracted from the paper in question, as well as some few which we shall yet present, the author feels that he has good and valid reasons for regarding "the condylar articulation of the mandible as the odontomorphic or tooth-shaping center,— that is, that they, the condyles, are the fulcra from whence all the dental impacts incident to mastication are controlled, giving us certain specific kinds of persistent movements which could effect modifications. The persistence of the type of movement renders its effect cumulative, whilst the addition of the factor of heredity renders it permanent."

In speaking of odontomorphic centers, the author says, "While making measurements of the skulls in the collection of the Academy some curious facts were elicited. It was observed that if a pair of dividers were taken, placing one point on the glenoid cavity of the skull or condyle of the mandible, the curvature of the cross-crests and intervening valleys of the molars of the same side would exactly coincide with that produced by a sweep of the free point of the dividers across them. The same rule was found to hold good in regard to the other side of the skull. We were not long, however, in finding that this rule was not universal among selenodonts; that there were some in which such a coincidence could not be obtained by the method described. It was then observed in these other cases that, if one leg of the dividers was placed on the posterior end of the basi-sphenoid bone, opposite to and midway between the glenoid cavities, for the superior molar series, and midway between the condyles for the mandibular molars, the arc described by the point of the free leg would now coincide in the curvature with the cross-crests and bottoms of the valleys of the molars of both sides when extended across their crowns."

For convenience, he designates the teeth the cross-crests of which coincide in curvature with arcs described respectively from the right and left glenoid cavities as centers for the molars of these sides respectively, as *biaxial;* and those where the center of this coincident arc is medial on the basi-sphenoid bone, or midway betwixt the condyle, as *uniaxial.* These centers may be named odontomorphic or tooth-shaping, since they are the fulcra which control the forces which slowly modify the shapes of the teeth and their component tubercles. The biaxial molar is by far the most

numerous, he having observed it in the following orders: *Edentata*, Proboscidians, most Rodents, *Perissodactyles*, Marsupials, and indeed most of the *Herbivora*, while the uniaxial was confined to the *Tragulidæ*, a species of deer, and a few Rodents.

FIG. 3



Ideal diagram showing the mode in which the lower molar series *a*, sweeps over the upper series *b*; the movement being constantly regulated from the mandibular articulation, or odontomorphic center, O.

The author says: "There seems to have been a metamorphosis of molars and premolars, which proceeded with greatest rapidity nearest the mandibular articulation, where the modifying forces were also applied with the greatest mechanical effect. The mandibular masticatory apparatus of mammals may be regarded as levers, in which the glenoid cavity is the fulcrum, the muscular force exerted by the masticatory muscles the power, and the resistance of the food to the teeth in crushing it the weight. Since the coefficient of muscular force is one hundred and four pounds per square inch of transverse section, it is easy to surmise what would be the tendency of the exertion of the force of many square inches in section of masticatory muscle upon the jaws and teeth in mastication. It would manifestly not be consumed in the mere comminution of the food, but it must also react upon the structures which were directly subjected to the resulting strains, viz. the teeth. In a mammal as large as the rhinoceros, the area occupied by the mandibular teeth is about five square inches, while the maxillary teeth occupy about ten square inches, as I have roughly estimated from a skull nearly adult; the ratio then of the triturating surfaces of the upper and lower series is about as one is to two. These ratios increase apparently as anisognathism increases, and conversely become equal as isognathism prevails,— that is, we may select a perissodactyl, such as the rhinoceros, or an artiodactyl,

such as the domestic ox, to represent one extreme, and the universal pig as the other."

The articulation of the mandible with the skull presents three well-marked types, viz., that observed in bunodont, with a more or less distinctly cylindroidal mandibular condyle, the selenodont, with transversely expanded and superiorly plane condyle, and the lophodonts, with a more or less nearly globular condyle, which in forms with much reciprocating movement becomes elongated antero-posteriorly, narrowed transversely, and fits, in some instances, into a well-marked, longitudinally disposed glenoid cavity. In those forms in which there is much lateral motion the rami of the mandible are also much more closely approximated than the molar series of opposite sides above; while in those forms without the excursive lateral movement there is little or no such difference in the interval between the molars of the upper and lower series respectively.

It is therefore apparent that the relations supposed to exist between mandibular movement and tooth forms must be extended so as to embrace not only changes in the form of the teeth, but also changes in the relations of the mandible and the form of their condyles and the glenoid cavities. The whole of these changes have been apparently dependent upon the mode of use of the parts and the force exerted.

It is further to be observed that those animals which have the most powerful masticating apparatus invariably have the most deeply implanted teeth, and the most effective arrangement for the replacement of tooth-structure when lost by wear.

The incisors of many animals having been lost or hypertrophied, either from the assumption of their functions by other parts, as the lips, tongue, or trunk, or by substitutions of another function, as in the case of the tusks of the Proboscidians, it would seem that mechanical resistance has much to do with their special development, as also seen in rodents.

A summary of the foregoing views the author has stated as follows:

"First. That the earliest and simplest type of mammalian jaw-movement was that in which the mouth was simply opened and closed, without mandibular excursion, and coexistent with the simple haplodont or bunodont molar.

"Second. That the development of the various kinds of excursive mandibular movement has apparently been progressive.

"Third. That as the excursive movements have increased in complexity there has been an apparent increase in the complexity of the enamel foldings, ridges and crests.

"Fourth. From the fact that the foldings, etc., have apparently been modified in conformity to the ways in which the force used in mastication was exerted, it is concluded that the various modes of crest and tubercular modification are related as effects to the diverse modes of mandibular movement.

"Fifth. It is apparent from the facts presented throughout the context that the mandibular articulations, and correlatively the whole skull, have probably been modified in shape by the movements made by the jaws and the forces exerted in executing them.

"Sixth. From the fact that incisor teeth are partially or entirely absent or relegated to another function in forms which have long prehensile tongues, mobile, prehensile lips or proboscides, it is held to be probable that such disappearance of the incisive dental elements is due to the assumption of their function by the prehensile organs indicated."

These views may also have some practical bearing upon dental science, and show that the edentulous theory advanced by our friend Dr. Thompson, based upon the degeneration of the human teeth, may have some foundation in science. The almost universal prevalence of dental caries and other dental deformities are doubtless in a large measure due to a want of a proper use of the teeth in comminuting harder food, which would be a constantly active stimulant, tending to produce a healthier and stronger development.

The long-established and increasing use of soft foods, in the light of the foregoing facts, has an unmistakable tendency to cause the teeth to become diseased, and, if there be truth in the doctrine of hereditary transmission, will in time render the human family more or less edentulous.

IN the July number of the "Practitioner," an English journal, edited by T. Lander Brunton, M.D., F.R.S., and issued by Macmillan & Co., 22 Bond street, New York, we find a very admirable article on "The Numeration of Blood Corpuscles and the Effect of Iron and Phosphorus on the Blood," by W. R. Gowers, M.D., Assistant Professor of Clinical Medicine in University College.

The accuracy of the description of the instrument for counting, made by Mr. Hauksley under his (the professor's) direction, is such that any one wishing to follow his experiments could readily do so.

With this instrument he arrives at the average normal number of red corpuscles in a cubic millimeter of blood, and also of the white corpuscles, which he states to be in proportion about as *1* white to *400* red.

Then follows the result of his experiments upon a number of patients, using *iron* and phosphorus in his efforts to remove an anæmic condition, noting the rise and fall in the number of red corpuscles as the different remedies are given or withheld; summing up with the statement that he has shown what a rapid and regular augmentation in the number of the corpuscles may be effected by iron, and that this effect is produced with perfect efficiency, by the chloroxide of iron (or dialysed iron). He says: "The manner in which the anæmia was removed is, however, not a little remarkable. The most characteristic effect of iron is believed, and rightly, to be an increase in the *hæmaglobin* of the blood — an improvement in its color. It has been denied, indeed, that it is capable of causing an increase in the number of corpuscles, but that it does increase the number is sufficiently proved by this and the following observations, confirming, as they do, those of Hayem and others. Moreover, the case shows that the primary effect of the administration of the iron may be an increase of the globules, out of all proportion to the increase in hæmaglobin, and that the rise in the latter may be accompanied by an actual decrease in the number of globules."

"Hayem rightly urges that it is not until the quality of the corpuscles is brought up to the normal, and the tint of the blood is

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NOTE.—A millimeter is 0.0394 of an inch. A meter is 39.37 inches. Diluting solutions — sulphate of soda and gum acacia.

such as corresponds to the number of normal globules, that the anæmia can be considered to be cured." "But it is evident that when such rapid increase in number occurs, we have strong reason to believe that an increase in their quality will follow, and thus the process of numeration affords a prognostic indication that the medicine given is doing good, and that the patient will regain health, an indication which is not furnished by any other method of examination."

"That a process of blood restoration, ultimately perfect, should commence with an increase in the number of globules, without corresponding improvement in their tint, shows that in laying stress on the latter, as the essential element in the cure of anæmia, we must not undervalue the former. This has been done, I think, by Hayem, in a recent paper on the action of ferrocyanide of potassium."

"He administered this drug to two chlorotic girls, and found in each a rapid increase in the number of corpuscles, without corresponding increase in the hæmaglobin." When the corpuscles had risen almost to the normal, he substituted iron; the corpuscles fell somewhat in number, but the amount of hæmaglobin increased until the 'value' of the corpuscles was that of health. Hence he concludes that ferrocyanide of potassium is quite useless in the treatment of anæmia, because it increases only the number, and leaves the 'value' of the corpuscles far below the normal,—but the changes in the blood, in the cases I have related, were almost the same, although an efficient preparation of iron was administered. The augmentation in number progressed for five weeks before any notable rise in value occurred."

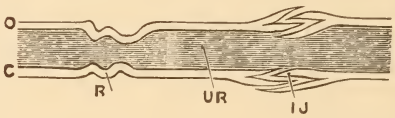
In each of his cases it is to be noted that a distinct rise in the amount of hæmaglobin occurred, amounting in one case to one-half, under the influence of the ferrocyanide, although the increase in the number of corpuscles was so great, from 3,000,000 to 5,400,000 per cubit millimeter, that the value of each corpuscle fell slightly. "It is evident, however, that each element in blood formation was stimulated, but the one out of all proportion to the other."

These facts I have brought forward here because they illustrate the need for further and more accurate observation on the mode of blood regeneration.

If there is any one thing upon which the dentist needs more systematic and thorough training, outside of his manipulative work, it is the knowledge which would fit him to deal with those stubborn anæmic cases which are so productive of neuritis.

In speaking of neuritis, a word here upon the minute anatomy of the ultimate nerve-fibre from Prof. Bolls, of Germany, may not be out of place:

He states broadly that the medullary matter is continuous, and that the outer tube or sheath is a compound, or more complex, structure, remaining after the cells from whence the nerve fiber was derived have fused, but the broken ends never become continuous, as will be seen by the above diagram, in which O C is the tube or sheath of the ultimate fiber, which is the remains of the cell from whence the contained medullary matter was derived. R is one of the Ranvierian constrictions, and IJ one of the imbricate junctions of the cells forming the sheath or tube. The medullary matter, UR, is protoplasmic neurine, and is continuous.



The Ranvierian constrictions are thought by some to be due to pathological conditions or to post-mortem changes.

While Prof. Bolls, of Germany, has been recording the results of his histological experiments, Dr. B. F. Lautenbach, of Philadelphia, has been, in a not widely different direction, making a series of experiments, the results of which were embodied in a paper presented in June, 1878, to the American Philosophical Society, entitled, "The effect of Irrelation of a polarized nerve, Pflüger's Electrionus." But previous to this presentation, a synopsis of it was given to the Microscopical Section, Academy of Natural Sciences of Philadelphia, under the title of Hemiplegia. His remarks upon that occasion were illustrated by diagrams showing the origin and decussation of the motor-fibres of the brain, the parts generally involved in hemiplegia, and explanatory of the experiments made by him in producing hemiplegia in the lower animals.

He recited a number of clinical cases in which hemiplegia did not follow destruction or removal of portions of the brain sub-

stance, and explained his experiments in producing and modifying paralysis in the lower animals by means of the continued and interrupted electrical currents, and by the injection of irritants, such as ammonia, saponine, etc.

He said that by the injection of ammonia, saponine, and other irritants, he had frequently produced hemiplegia in the lower animals, a result never accomplished in them before. The hemiplegia was persistent if the amount of the irritant was large, but temporary if small.

He concluded his remarks by affirming that hemiplegia of cerebral origin is due to polarization of the nerve fibres.

Upon inquiry as to whether these substances had been used in tetanus in man, Dr. Lautenbach replied that it had, but with only partial success. Another inquiry was made as to the results of his observations in the light of the experiments of Hitzig, Ferrier and others, to which he replied, that the motor centers located by these observers, according to his experiments, did not always exist; that he had frequently removed these so-called centers from dogs without producing sufficient paralysis to prevent them from running away.

The subject of the distribution of ciliated epithelium has within the last year elicited considerable interest, and in view of this I present the following résumé:

The term epithelium is usually applied to those cells which lie upon the surface of membranes, such as the skin or mucous membrane, and those which are found in the cavities of glands, continuous with these surfaces.

Beale says, "There are two principal varieties of epithelial cells: first, those that serve the part of a protective covering; second, those which take part in the separation or elaboration of substances entering into the composition of the secretions. In the first class may be comprised scaly, tessellated, columnar and ciliated epithelium, while the second includes the different varieties of glandular or secreting epithelium."

Ciliated epithelium has not until quite recently been recognized upon the intestinal canal of man, but the researches of Dr. J. G. Hunt, of Philadelphia, have been so successful as to satisfy him of its presence there. This being the case, a few words, reproducing

what histologists have long since accepted as correct respecting it, will not, I trust, be here out of place.

Ciliated epithelium is described as of two principal varieties, one consisting of small cells, of nearly the same length and breadth, and the other of the prismatic or cylindrical form. In origin it is, by Prof. Haeckel, Dr. George Allman and others, supposed to be developed from processes of protoplasmic substance, which first undulates, then becomes globular and elongates into a ridge, and subsequently splits into parallel bands, rapidly changing into cilia. In location it is found in the intestinal canal of the Invertebrata, sponges, polyps, echinoderms, worms, a few crustaceans and insects, and in all of the Mollusca. In some of the crustaceans and insects, in consequence of the tendency to chitinous covering and chitinous plates upon the intestinal canal, the ciliated epithelium is not found. Beale has recognized it in the human subject in the following situations: On the surface of the ventricles of the brain; on the mucous membrane of the nose, and its sinuses; on the upper and posterior part of the soft palate, and in the Eustachian tube; in the cavity of the tympanum; on the membrane lining the frontal and sphenoid sinuses; on the inner surface of the lachrymal sac and lachrymal canal; on the mucous membrane of the larynx, trachea and bronchial tubes; upon the os uteri; within the cavity of the uterus; throughout the whole length of the Fallopian tubes, and upon their extremities. With the distribution above given, which is thoroughly recognized, it is highly probable that the discovery announced by Dr. Hunt will be sustained by subsequent investigations, and that ciliated epithelium will be found to exist in the intestine of man, as well as of all the Mammalia.

VOLUNTEER PAPER ON HISTOLOGY AND MICROSCOPY.

By C. F. W. BÖDECKER.

THE DISTRIBUTION OF LIVING MATTER IN HUMAN DENTINE, CEMENT, AND ENAMEL.

As long as dry specimens were used for minute examination of the hard tissues of teeth, it was impossible to obtain clear ideas as to the presence and distribution of living matter within these tissues. Dry specimens are *mummies*, in which the basis-substance, infiltrated with lime-salts both in bone and teeth, remains relatively unchanged, but the soft tissues necessarily shrivel and fade away from the moment that a piece of bone or tooth is allowed to dry. No doubt our knowledge of the minute structure of these tissues could be increased by observing, with relatively low powers, dry specimens which have been ground thin and mounted in Canada balsam or Damar varnish. From the moment, however, that we begin to study such specimens with higher powers (about 500 diameters), our task becomes utterly unsatisfactory, inasmuch as only spaces (lacunæ, canaliculi, tubuli, etc.) can be seen, either empty or filled with air or dirt.

No one, I think, will doubt that as long as a tooth is within the jaw and in close connection with the living tissues of the body, it is alive. Morbid processes, especially caries, produce more or less painful reactions in the tissues of the tooth, even before the pulp-cavity has been invaded and an inflammatory process established. It is a daily occurrence that the cutting of apparently healthy tissue, either enamel or dentine, is a more or less unpleasant, nay, painful, manipulation for the patient, especially on the boundary between the enamel and dentine; moreover, the neck of the tooth is known to be very sensitive.

These facts, besides alterations, as produced by foreign bodies brought in contact with dental tissues, viz. fillings of any kind, show that there must be living matter present within these tissues capable of conducting sensations to the nerves of the pulp, and reacting through an inflammatory process around foreign bodies, the so-called consolidation analogous to eburnification in bone-

tissue. Many good observers were aware of the presence of living matter in the teeth,— nay, some thought of the presence of nerves within these hard tissues. All, however, failed in demonstrating the living matter in its most intricate distribution, partly owing to the wrong method applied to the preparation of microscopical specimens, and partly to a want of knowledge of the arrangement of the living matter in other tissues, especially in bone.

In 1873, Dr. C. Heitzmann *(Sitzungs-Berichte der Kaiserl. Akad. in Wien)* first discovered the minute structure of protoplasm and that of other tissues of the animal body, mainly epithelium and connective tissue. This author describes the net-like structure of the protoplasm thus: "The nucleolus is connected with the wall of the nucleus, and this again with the granules of the protoplasm, by very fine threads, which are to be regarded as the living matter of the protoplasm, while the fluid contained within these meshes of living matter does not possess the property of life." That these assertions are correct can easily be proved by close examination with a good immersion-lens magnifying at least 1000 linear. In micro-photographs this structure is plainly visible wherever a protoplasmic body is in correct focus. Several reliable German microscopists have accepted the described structure of protoplasm as a well established fact. The structure is identical in all protoplasmic formations, in the simple amœbæ as well as in colorless blood-corpuscles of vertebrates and all protoplasmic bodies (the formerly so-called cells of the tissues) of any description. The author referred to discovered, in 1873, that there does not exist a tissue within the animal body built up by isolated cells, as taught by Theodor Schwann. What was formerly thought to be a cell (a vesicle filled with a fluid and a nucleus suspended therein) has been, since 1861, through the researches of the late Max Schultze, recognized as "a jelly-like mass,—the so-called protoplasm." Since Dr. C. Heitzmann's observations, it is conceded that in all varieties of connective tissue the protoplasmic bodies being imbedded in a mucoid or a glue-giving basis-substance, at the same time are connected with each other by offshoots of the living matter, which spring from the protoplasmic body of the tissue,—the formerly so-called cell,— and traverse the basis-substance in the shape of a net-work. The net-work of living matter present in the protoplasm is identical with the net-work in the basis-substance, the only dif-

ference being that the net-work in the latter is a little wider than in the former; and further on, that in the meshes of the protoplasm there is present a lifeless fluid, while the meshes of the basis-substance contain a mucous or glue-giving substance, originating from the chemically altered and solidified protoplasmic fluid. The history of development of connective tissue illustrates the origin of both the living matter and the lifeless basis-substance — at least from the morphological stand-point — in a satisfactory manner.

In the tissue termed "epithelial" there are protoplasmic bodies closely packed together, so much so that the single bodies flatten each other, and each one shows a more or less polyhedral shape. The single epithelial bodies are separated from each other by a cloak of cement-substance, which gives the horny character to all epithelial formations. The said author demonstrated that in all epithelial bodies still endowed with life (except the dry desquamating epithelia on the surface of the body, and of certain cavities of the same) the net-work of living matter is present within the protoplasm, and sends parallel offshoots through the cement-substance, by which all protoplasmic bodies of the epithelium are uninterruptedly connected with each other. What Max Schultze, in 1864, described as thorns of the cement-substance, present in a few epithelial formations only, must be considered as products of living matter piercing the cement-substance in all epithelial and endothelial formations, though often brought to view only by the application of certain reagents.

It is evident that the old cell doctrine is not tenable. The animal body is by no means built up like a chimney or a dwelling, the bricks being represented by the cells. The organism, according to the new doctrine, for which the term "bioplasson doctrine" has been proposed, must be considered as an engine in which all constituent elements are in close contact respectively in an uninterrupted series with each other, in order to enable the whole to perform its duty. A screw, as such, may be regarded as an individual, but if put in the right place its individuality is lost; it works further on for the benefit of the whole. A single screw being loose may produce great disturbance in the action of the machine, and in an analogous way morbid action may separate protoplasmic bodies, and thus produce a great deal of disturbance,

either locally or generally, according to the dignity of the diseased tissue.

The bioplasson doctrine, thus briefly detailed, seems to me, after several months' study, very plain.

The tissue of the greatest interest to me is bone, which I studied both in the normal and dead or necrotic condition, the results of which I have laid down in the article "Necrosis" (*Dental Cosmos*, May, 1878). To enable the reader to understand what I later on intend to say on the tissues of the teeth, I propose to recapitulate briefly what I found.

The lacunæ of bone-tissue are the spaces in the glue-giving basis-substance, each of these spaces containing a protoplasmic body, with a distinctly visible net-like arrangement, to be regarded as the living matter of the protoplasm. The basis-substance of bone is pierced by canaliculi, which communicate with each other as well as with the lacunæ. I succeeded in finding a much more delicate net-work of canaliculi than observers have hitherto thought to be present.

The protoplasmic bodies, which do not quite fill the lacunæ, send offshoots of the living matter into the canaliculi, although these offshoots are plainly visible only in the coarser canaliculi. The presence of living matter in the finest canaliculi we have to assume, owing to the fact that from the whole periphery of the protoplasmic body within the lacuna there are projecting delicate conical offshoots, which spring with their basis from the protoplasmic body, traverse the light seam between this body and the wall of the lacuna, and are directed with their delicate ends toward the finest canaliculi, where they are lost to sight.

Methods.

The best method for preparation of bone-tissue for microscopical purposes is doubtless the treatment with chromic-acid solution of the strength of a half to one per cent. The same treatment has repeatedly been resorted to by different investigators of tooth-substance. I have used this solution extensively for this purpose, with precautions suggested by the experience on bone. These are, to immerse only a few teeth in a large vessel with a considerable amount of chromic-acid solution; to renew the same every third or fourth day, and add, to enforce the action of the fluid,

very small quantities of dilute hydrochloric acid. By this treatment the teeth, after a few months, become dark-green from the reduction of the chromic acid to the sesquioxide of chromium. This method is doubtless the best for softening teeth, both human and animal, when still in the jaw. Wonderful specimens can be obtained in this way by cutting bone and tooth at the same time, also for preparing specimens from embryos, in order to study the history of development of teeth. This method is highly recommended, although the chromic acid softens the cement and dentine only to a certain depth, so much so that a tooth kept never so long in the chromic-acid solution never is fit to be cut through in its whole width at one time.

The sections so obtained are ready for staining with carmine or hæmatoxylin after they have been immersed in and washed with distilled water, also for staining with chloride of gold, which latter may be done in the following way: thin sections, after having been washed in distilled water for twenty-four hours, and thus freed from the remnants of chromic acid, are to be placed in a solution of chloride of gold of the strength of half of one per cent, by means of glass rods, as metals must be avoided in the treatment with chloride of gold. These sections are to remain in the solution for a half to one hour, and must then be thoroughly washed with distilled water and exposed to daylight for several days, when they are ready for mounting in the ordinary way in glycerin diluted with fifty per cent of distilled water.

The greatest objection to the chromic-acid treatment is that enamel never can be obtained in connection with the dentine. If hydrochloric acid has been used in addition to the chromic-acid solution, the enamel is almost completely dissolved. If chromic acid alone has been used, the enamel becomes so brittle that it crumbles into small particles under the knife. Under such circumstances the outer surface of the dentine looks as if corroded, or baylike, owing to the curved lines on the boundary between the dentine and enamel.

Lactic acid acts upon teeth, if diluted sufficiently, by dissolving the lime-salts much faster than chromic acid. Specimens prepared in this way, however, in my experience, are not distinct enough for study with high powers; hence a tooth, after being softened with lactic acid, has to be immersed in chromic-acid solution for

several weeks. But the greatest objection against the use of the lactic-acid solution is the formation of mildew in a relatively short time, and the dissolving of the enamel from the teeth.

The only method which enabled me to obtain specimens of teeth provided with all hard tissues is the following: a fresh tooth, or one kept a short time in chromic-acid solution, is sliced under water by a watch-spring saw, and ground as thin as possible upon a corundum-wheel of a lathe, always being kept under water. The lamella thus obtained should be placed in a large quantity of chromic-acid solution of the strength of half of one per cent for one or two days, with the view of hardening the soft parts of the tooth and dissolving the lime-salts. After this the specimen may be stained with carmine, hæmatoxylin, chloride of gold, etc., as above described, and mounted in dilute glycerin.

The saturated solution of picric acid in water may also be used for the decalcification of a ground slice of a tooth, though the precipitated acid must be afterward removed, either by a brush or the blade of a knife. Very handsome specimens can be obtained by staining them with carmine after the treatment with picric acid.

Dentine.

We know that the basis-substance, or matrix of the dentine, is analogous to that of bone, viz., glue-giving, and at the same time infiltrated with lime-salts. We learned from the researches of E. Neumann that the basis-substance is denser on the walls of the tubuli, and more resistive to the action of strong acids, which cause the appearance of a sheath around each tubule after the solution of the intermediate substance of the matrix between the tubuli. Analogous relations also exist in bone-tissue, in which the basis-substance is decidedly denser on the walls of the lacunæ and Haversian canals.

With low powers we cannot see in the dentine anything but the tubuli, which I propose to term hereafter Dentinal Canaliculi. These canaliculi, as is well known, run in curved sigmoidal lines from the boundary of the pulp-cavity to the periphery of the dentine; they are directed obliquely upward in the crown, and assume a more horizontal direction in the region of the neck, while in the root they remain horizontal or sometimes turn downward to a varying extent. Besides the main sigmoidal curvature,

each individual canaliculus exhibits a more or less wavy course in its way through the dentine, and the individual curvatures are, as a rule, very marked on the outer periphery of the dentine.

The dentinal canaliculi reach the outer surface of the dentine only on the circumference, which is covered by enamel, while on the periphery coated by cementum, including also the neck, the canaliculi terminate before reaching the cementum, and are replaced by a fine granular basis-substance greatly varying in its width.

The distribution of the dentinal canaliculi is in the great majority of teeth uniform throughout the dentine, although exceptionally I have met with specimens of dentine in which there were smaller or larger territories devoid of dentinal canaliculi; which latter looked as if arranged in bundles or groups within the basis-substance. This relation is especially visible on transverse sections of the dentine. An irregular arrangement of the dentinal canaliculi is more common in the roots than in the crowns.

Each canaliculus contains a dentinal fiber. These fibers, when viewed with a power of 500 on good chromic acid specimens, exhibit a pale-gray color, and run through the midst of the tubuli without ramification up to the outer surface of the dentine. The outlines of these fibers never are smooth, but always look denticulated or fringed. On specimens treated with chloride of gold, the fibers and their delicate offshoots show a distinct violet color, characteristic of living matter within protoplasmic formations, while the space between the fiber and the wall of the canaliculus remains unstained, and the basis-substance between the tubuli only assumes a slight violet tinge.

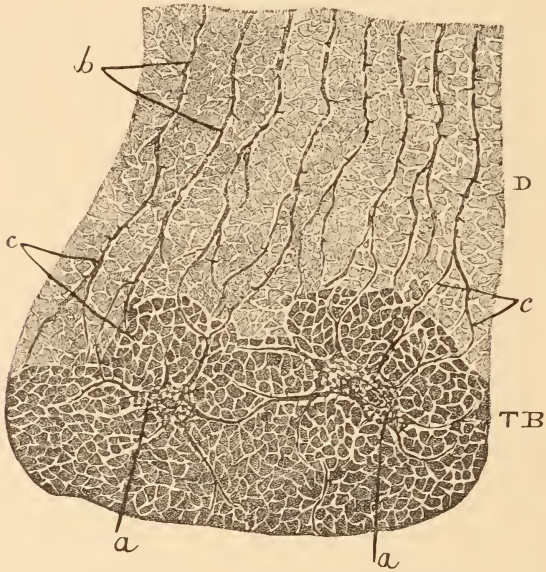
Longitudinal sections of dentine, stained with carmine or chloride of gold, if examined with high powers — from 1000 to 1500 diameters (immersion lenses) — exhibit the following:

The canaliculi of the dentine run in a more or less wavy course through the basis-substance, and are, as a rule, bifurcated only on the periphery of the dentine, both toward enamel and cementum. Each canaliculus contains a central, slightly-beaded fiber, which on its whole periphery sends delicate thorn-like elongations through the light space between the central fiber and the wall of the canaliculus. The thorns are distinctly conical, their bases being at-

tached to the dentinal fibers, and their points directed toward the basis-substance. The smallest thorns spring in an almost vertical direction from the dentinal fiber, while somewhat larger offshoots may run obliquely through the basis-substance, and directly unite neighboring fibers with each other in the vicinity of the enamel and cementum.

The basis-substance shows a distinct net-like structure. The light spaces surrounding the dentinal fibers send delicate elonga-

Fig. 1



Cross-section of root of molar. Stained with half per cent solution of chloride of gold. Magn. 1200 diam. *D*, dentine; *TB*, cement (tooth-bone); *a a*, protoplasmic bodies of the cement, branching and uniting; *b*, dentinal fibers, with their transverse offshoots; *c c*, ramification of dentinal fibers and their union with the offshoots of cement-corpuscles.

tions into the basis-substance, in which, through repeated branching, a light net-work is established, the meshes of which contain the decalcified glue-giving basis-substance. The finest offshoots of the dentinal fibers can be traced only into the mouths of the elongations of the canaliculi; on the periphery of the latter, owing to their great delicacy, the offshoots are lost to sight. Coarser offshoots of the dentinal fibers, at the localities mentioned before, traverse the basis-substance within its light net-work, at the same

time uniting dentinal fibers directly, and sending slender conical offshoots into the light net-work of the basis-substance.

The dentinal fibers are either in direct connection with coarser offshoots of the protoplasmic bodies of the cementum, or the light net-work of the basis-substance of the dentine is in communication with that of the basis-substance of the cementum.

The latter condition prevails on the periphery of the neck of the tooth, where the basis-substance of the dentine is not pierced by larger offshoots of the dentinal fibers, but only by a delicate net-work, through which the connection between dentine and cementum is indirectly established.

Where the dentine is in contact with the pulp, the dentinal fibers directly communicate with the odontoblasts (John Tomes) in a growing tooth, and with the protoplasmic bodies of the pulp in a fully developed condition, where no regular odontoblasts can be seen.

In cross-sections of dentine the dentinal canaliculi are visible in the shape of round or oblong holes; the center of each is occupied by the dentinal fiber, which has the shape of a small roundish dot. Again we see that the periphery of the dentinal canaliculus is sharply marked, and repeatedly interrupted by light offshoots leading into the light net-work which pierces the basis-substance between the canaliculi. The central fibers look very distinct and dark-violet in specimens stained with chloride of gold, and send slender, conical, radiated offshoots through the surrounding dentinal canaliculi, respectively toward the mouth of the light interruptions in their walls.

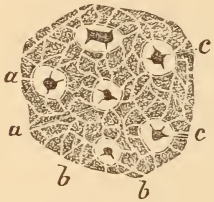
In directly transverse sections, one, two, or sometimes even three, such offshoots can be seen in a star-like arrangement. Each offshoot springs with a broad base from the central dentinal fiber, while its pointed end always is directed toward the perforation in the wall of the canaliculus, where, as a rule, it is lost to sight. Slightly oblique sections of the canaliculi exhibit both transverse and longitudinal projections of the dentinal fibers. In such an oblique section we may succeed, by cautiously changing the focus, in seeing star-like radiated offshoots up to five in number, all arising from a single dentinal fiber.

Toward the boundary between dentine and enamel, and dentine and cementum, as is well known, the dentinal canaliculi ramify,

and according to their ramifications also the dentinal fibers bifurcate, becoming thinner the nearer to the surface of the dentine. Both longitudinal and transverse sections of this part of the dentine show details identical with the main mass of the dentine, the only difference being that near the periphery of the dentine the fibers are more delicate and more closely packed together.

In some teeth I have met on the periphery of the dentine of the crown with the so-called "Interglobular Spaces" (Czermak),

FIG. 2



Cross-section of dentine of incisor. Stained with half per cent solution of chloride of gold. Main mass of dentine. Magn. 2000 diam. *a a*. dentinal canaliculi with the central dentinal fiber *c c*, the latter with star-like offshoots; the basis-substance between the canaliculi pierced by a delicate light net-work *b b*.

FIG. 3

Cross-section of dentine of incisor. Stained with half per cent solution of chloride of gold. View from outer periphery of dentine near enamel. Magn. 2000 diam. *a a*, dentinal canaliculi with the central dentinal fibers *c c*, the latter with star-like offshoots; the basis-substance *b b* between the canaliculi pierced by a delicate light net-work.

which may be considered as remnants of the embryonic condition of the dentine. They represent lacunæ of greatly varying sizes, bounded by curved lines, the convexities of which are directed toward the central cavity. These spaces sometimes contain protoplasm,— that is to say, embryonal elements which have not been transformed into basis-substance and not calcified. The dentinal fibers enter the protoplasmic bodies, and each fiber is united with the net-work of the protoplasm by means of delicate thorn-like projections. At other times the basis-substance of the dentine is developed within the interglobular spaces, but devoid of lime-salts. In this instance the dentinal fibers, without investment and without changing their course, pierce the basis-substance and send offshoots to this through the surrounding light spaces.

The dentine shows peculiar formations in general, though not constantly, as instanced when approaching the enamel and cementum. These formations, however, being in close relation to the covering tissues of the tooth, I prefer to describe in the chapter on cementum and enamel.

Cementum.

It has been long known that there exists a striking analogy between the structures of the cementum and bone.*

If we consider the central or pulp-canal of the tooth as a formation analogous to a Haversian canal, containing blood-vessels, nerves and medullary tissue, then the surrounding cementum corresponds to a Haversian system of ordinary bone, between which and the pulp-canal there exists an intermediate stratum of dentine.

The zone of dentine is not present all around the pulp-cavity on the apices of the roots; there the cementum, being the outermost layer of the tooth, directly lines the cavity.

Delicate parallel striations are to be seen in the cementum, identical with the lamellæ of a Haversian system, and as a rule more plainly marked near the periphery than toward the dentine. The lamellæ exhibit a more or less concentrical arrangement around the pulp-cavity, easily demonstrable on cross-sections.

Within the basis-substance of the cementum there are numerous branching spaces, in correspondence with the lacunæ of bone. The offshoots of these spaces in the cementum, like the spaces themselves, are very marked in dry specimens, because of their being filled with air. In chromic acid specimens, on the contrary, the offshoots are much less prominent, and the less, the more thoroughly the decalcification has been effected by the acid. No essential difference is noticeable between the lacunæ and canaliculi of ordinary bone and those of the cementum; in both tissues there exists a great variety as to the general arrangement, the size of the lacunæ, the number and ramifications of their offshoots.

The walls of the lacunæ and the coarser offshoots, if viewed with a highly magnifying lens (immersion, 1000 to 1500 diam.), appear interrupted on their peripheries by light spaces, which lead into a light, delicate net-work, piercing the whole basis-substance to such an extent that only the meshes have to be considered as the fields of calcified glue-giving basis-substance.

Each lacuna contains a protoplasmic body, with a central nucleus — the cement-corpuscle. The nucleus sometimes is relatively

* By some authors the dentine has been termed "Tooth-bone." It seems as if this name were applicable with considerably more propriety to the cementum; the latter term having no proper sense. The difficulty of introducing new nomenclature into anatomy, on the one hand, and the shortness of the word cementum adapting it for combinations, such as cementitis, etc., are the reasons why I retained this term.

large, and surrounded only by a narrow seam of protoplasm; while in some small lacunæ a body of the appearance of a nucleus is present without a noticeable amount of surrounding protoplasm. The net-like structure of both the nuclei and the protoplasm is plainly visible on all cement-corpuscles. From the periphery of each corpuscle conical offshoots arise, the coarser of which penetrate into the larger offshoots of the lacunæ, while the finest offshoots of the protoplasm traverse the light rim between the wall of the lacuna and the periphery of the protoplasm, being directed toward a light interruption on the boundary of the lacuna.

Cement-corpuscles, on the average, are round or spindle-shaped bodies, the long diameter of which corresponds to the direction of the lamellæ. In teeth of juvenile and middle-aged persons we meet with cement-corpuscles surpassing three or four times the size of ordinary ones, in which two or three nuclei are visible. Instead of multinuclear bodies, a number of medullary nucleated elements may fill a large lacuna, all these elements being connected with one another by very delicate threads. The longitudinal diameter of such large lacunæ is sometimes arranged radiately, therefore, vertically to the direction of the lamellæ.

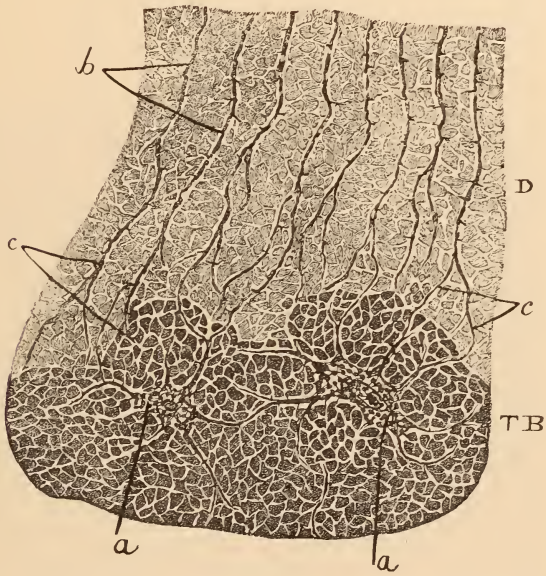
Numerous cement-corpuscles send broad and branching offshoots through the basis-substance in a vertical or oblique direction to the lamellæ, and not infrequently a direct union is established between two or three cement-corpuscles by means of such large offshoots (Fig. 4, *a a*).

In some teeth broad, spindle-shaped spaces pierce the cementum in a radiated direction, all of which contain protoplasm with delicate offshoots directed toward the net-work in the basis-substance. Nay, sometimes medullary spaces traverse the lamellæ in different directions, which, besides a varying number of medullary elements, contain capillary blood-vessels, evidently in connection with the capillaries of the periosteum. These formations may be considered as remnants of the embryonic condition of the cementum, and are never present in large numbers. All protoplasmic formations within the cementum, though greatly varying in shape, agree in being connected with each other by the delicate net-work, which pierces the basis-substance.

On the periphery of the cementum, on the line of the connection with the periosteum, the net-work of the protoplasm is usually

very broad, and the fields of the basis-substance show a prevailing globular appearance. Also, numerous spindle-shaped protoplasmic bodies are seen in connection with the cementum in an oblique arrangement, forming the transition into the structure of the periosteum. Between the calcified cementum and the striated connective tissue of the periosteum there often exists a narrow zone, occupied by closely-packed, spindle-shaped protoplasmic bodies only. In the periosteum itself there are less numerous, partly nucleated protoplasmic bodies, between which the fields of an apparently homogeneous glue-giving basis-substance are seen.

Fig. 4



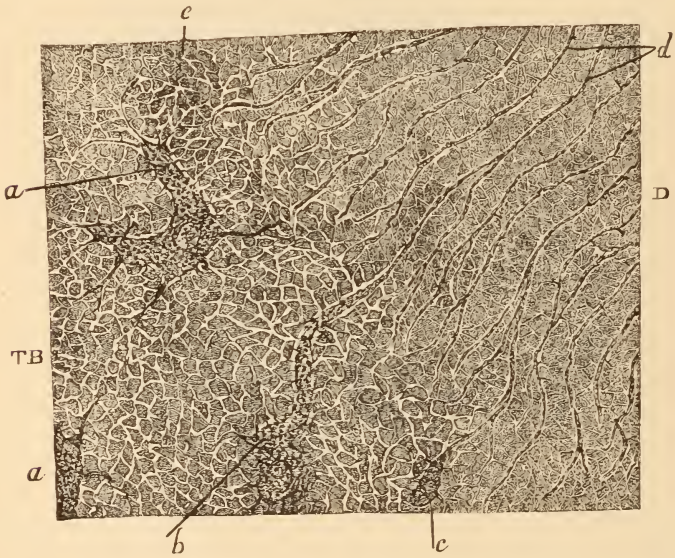
Union between dentine *D* and cement *TB*; *a a*, cement-corpuscles with large, branching offshoots, connected with each other as well as with the dentine-fibers *b*, at the bifurcation of the latter *c c*. Magnified 1200 diameters.

The connection between dentine and cementum is established either by a gradual change of one tissue into the other, without a distinct line of demarkation, or there exists a boundary formed by a more or less marked wavy line, presenting irregular bay-like excavations. Lastly, it occurs that between the bay-like excavations and the dentine there is interposed a stratum of the structure of

cementum, with a gradual change of the tissue of the former into that of the latter.

Where a gradual change takes place, the dentinal canaliculi show irregular, mainly spindle-shaped enlargements, which stand in the direction of the dentinal canaliculi themselves, or run obliquely through the basis-substance of the cementum. The distal end of such a spindle is, as a rule, in connection with a regular lacuna of the cementum, or with an analogous formation of a neighboring dental canaliculus. Many of the latter simply pass into the light, delicate net-work characteristic of the basis-substance of cementum. The dentinal fiber is in direct union with the protoplasm, which fills the spindle-shaped spaces, or it is lost to sight upon entering the net-work of the basis-substance of the cementum.

Fig. 5



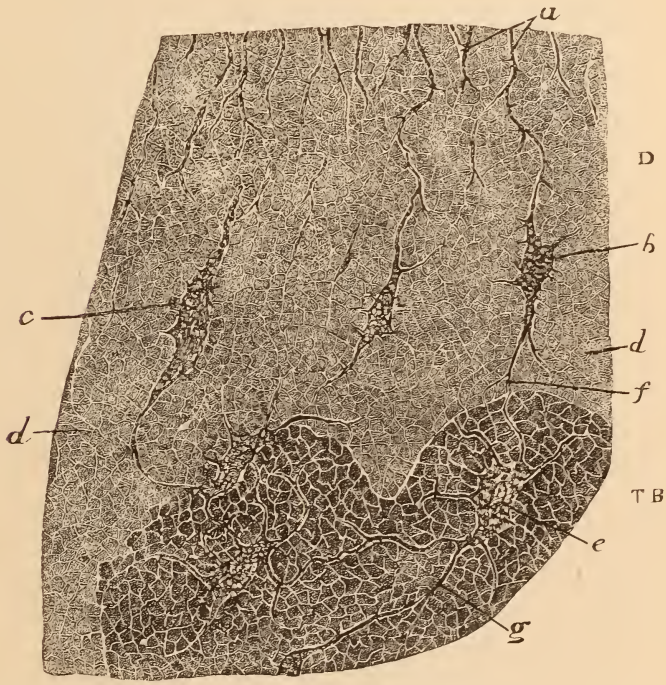
Transition of dentine *D* into cementum *TB*. without a marked boundary; *a a*. ordinary cement-corpuscles *b*, spindle-shaped large, and *c*, spindle-shaped small, cement-corpuscles, both in direct connection with dentinal fibers *d*. Magnified 1200 diameters.

Where a boundary with bay-like excavations is present between dentine and cementum, spindle-shaped enlargements of the dentinal canaliculi may be seen much smaller than in the former instance. The majority of the dentinal canaliculi, however, reach the

boundary of the cementum after repeated bifurcations, by which both the calibers of the canaliculi and their central fibers are gradually diminished in size.

A connection of the dentinal fibers with the coarser offshoots of the cement-corpuscles is often observed. The light net-work of the basis-substance of the dentine always passes into that of the cementum. Not very rarely, also, on the bottom of a bay-like excavation, partly nucleated protoplasmic bodies are present, into which

FIG. 6



Transition of dentine *D* into cement *TB*, with an intermediate layer of cement structure; *a*, bifurcating dentine-fibers, in union with elongated cement-corpuscles *b* and *c*, the latter imbedded in the basis-substance *d*; between this and the regular cement, with protoplasmic bodies *e*, the wavy boundary; all cement-corpuscles united with each other by large offshoots *f* and *g*. Magnified 1200 diameters.

the dentinal fibers inosculate. The connection between these and the coarser offshoots of the cement-corpuscles under these circumstances is established by such intervening protoplasmic bodies.

For the designation of the protoplasmic formations between the

dentine and enamel, and dentine and cementum, I choose the term "Interzonal layer," as first proposed by Dr. W. H. Atkinson.

Neck of Tooth.

There are certain peculiarities about the minute anatomy of the neck of the human tooth which, so far as I can judge from the literature within my reach, have not been heretofore mentioned.

John Tomes ("System of Dental Surgery," 1873), in describing the distribution of the dentinal tubes, says: "Near the neck they stop short of the cementum."

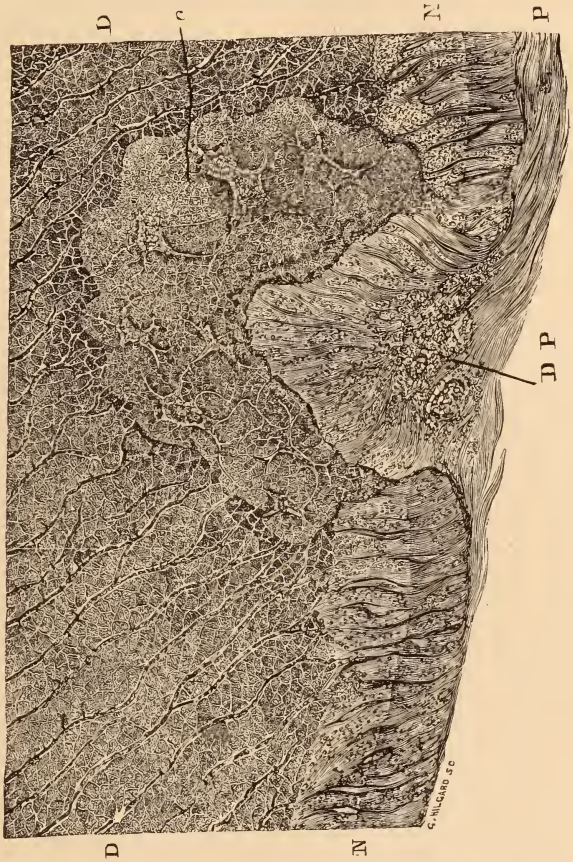
This assertion is in accordance with my own observations. In the great majority of teeth neither the canaliculi nor their contents, the dentinal fibers, reach that part of the cementum which surrounds the neck. Near the periphery of the dentine bifurcations of the canaliculi — and consequently also of their tenants, the dentinal fibers — take place, some of the finest terminations of which run to the boundary between the dentine and cementum. As a rule, the finest terminations of these fibers are lost to sight in a net-work somewhat coarser than that of the basis-substance of ordinary dentine. The minute elongations of the dentinal fibers can also be traced into the light net-work with more distinctness than elsewhere in the dentine. Sometimes the dentinal canaliculi, when approaching the periphery, become slightly dilated so as to produce slender pear-shaped cavities, in accordance with which the terminating dentinal fibers exhibit slight enlargements.

The boundary between dentine and cementum presents a wavy line, traversed by delicate threads, or occupied by spindle-shaped protoplasmic formations, all of which are in union with direct or indirect elongations of the dentinal fibers.

The cementum around the neck forms a narrow layer, which is cut off obliquely at the place of junction with the enamel. Both the cementum and enamel in this situation — being of the same width — are separated by a boundary which runs from the outer periphery obliquely downward to the dentine. This relation I found in the majority of teeth, and it is only exceptionally that I have met with cementum regularly overlapping the enamel. The cementum on the neck is built up by delicate prisms, or spindles, arranged vertically to the surface of the dentine. The prisms

represent the fields of the basis-substance, and are separated from each other by light rims, holding beaded fibers, or traversed by delicate vertical threads. In transverse sections, when the prisms are cut obliquely, they exhibit irregular opaque fields, separated from each other by light rims.

FIG. 7



Anomalous formation of cementum on the neck of a human tooth. *D D*, dentine; *N N*, cementum on neck of tooth, with spindle-shaped or prismatic fields of basis-substance; *D P*, depression in the cementum of the neck, filled with elements of periosteum, surrounded upward by a zone of regularly developed cementum. Magnified 1200 diameters.

These formations closely resemble the protoplasmic bodies of the periosteum next to the cementum, alluded to in the former

chapter; hence I do not hesitate to consider the bony formation on the neck as being produced by calcification of the osteoblasts of the periosteum. The cementum on the neck of the tooth is devoid of lamellæ and lacunæ, which appear deeper below, together with all the characteristic features of the fully developed structure of the cementum. The lamellæ become the more distinct, and the lacunæ, with their contents (the cement-corpuscles), the more numerous, the broader the diameter of the layer of the cementum.

The outer surface of the cementum is covered on its upper part with epithelial elements, in close resemblance with those of Nasmyth's layer of the enamel. This layer turns over into the epithelial coat of the gum. Farther down, the cementum, though still endowed with properties characteristic of the neck of the tooth, is surrounded by the fibrous connective tissue of the periosteum.

I have met once with striking formations on the neck of a tooth, which I consider anomalous, but not quite pathological. Here the ordinary cement of the neck is interrupted by grooves or pits containing the elements of periosteal tissue. The inner periphery of the pit is covered with a well-developed, evidently isolated, formation of cementum. The island of the cementum is broadest above the bottom of the pit, and slopes down along the walls of the pit until it is lost within the layer of the cementum of the neck.

Enamel.

The best specimens for examination of enamel I obtained by grinding fresh teeth and staining them for one hour with the half per cent solution of chloride of gold, as mentioned in the description of methods for the examination of teeth in general.

Up to this time the impression of most examiners has been that the enamel is built up by bundles of rods, or prisms, crossing each other, and traversed by faint vertical lines, which give each of them the appearance of a column, subdivided into small squares. The enamel-rods doubtless exist, and are wavy close to the dentine, and straight on the periphery and the main mass of the enamel. They may be considered as columns of a calcified substance, between which minute spaces are left, analogous to the cement-substance of epithelial formations.

FIG. 8

Longitudinal section of enamel. *a*. enamel-rods. traversed by prevailing vertical spaces; *b*. enamel-fibers, branching and partly uniting through delicate offshoots; numerous fine thorns of the fibers directed toward the light interruptions within the rods. Magnified 1200 diameters.

In longitudinal sections we see delicate beaded fibers, which occupy the central portion of the interstices between the enamel-rods. These fibers I propose hereafter to term the "Enamel-fibers."

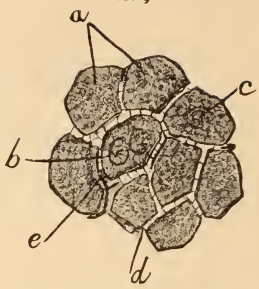
From such a fiber arise very minute conical fibrillæ, which traverse the rims between the fiber and the neighboring outlines of the rods, and fade away from the moment they enter the latter. The columns of the basis-substance themselves are pierced by delicate canaliculi, running in an almost vertical direction through the enamel-rods, regularly enough to give the appearance of squares, although these are much smaller than usually represented in the books. In the midst of a minute square light canals are seen, not infrequently running parallel with the outlines of the enamel-rod. The square fields thus produced by the rectangular crossing of light channels look, under the power of 1200 diameters, finely granular. In specimens not fully decalcified it is impossible to decide whether there is a light network within the enamel-prisms analogous to that in the basis-substance of the dentine and cementum, or whether the granular appearance is merely due to the depositions of lime-salts. In thoroughly decalcified specimens of enamel, however, such as were first made by Dr. Frank Abbott, there is no difficulty in seeing, with high powers, the reticular structure of protoplasm. I am indebted to the above-named observer for having first drawn my attention to this fact.

Cross-sections of the enamel, which we obtain also in longitudinal sections of the tooth, on account of the different directions of the bundles of the enamel-rods, plainly exhibit the irregular polyhedral fields of the enamel-rods. The light interstices between the polyhedral fields contain, in many instances, delicate-beaded fibers, surrounding the polyhedral fields of the enamel-rods. The fibers, if cut transversely, have the appearance of dots, and connect with each other directly or by means of intervening delicate threads.

Extremely fine thorns traverse in a vertical direction the light

space between two neighboring enamel-rods, even where a fiber is not visible. These threads are identical with the delicate thorns, first described by Max Schultz in 1864, in the cement-substance of epithelial formations.

Fig. 9



Cross-section through enamel. *a*, rods of enamel, partly exhibiting formations like nuclei; *b*, *c*, *d*, light interstices between the rods traversed by delicate beaded fibers *e*, or by vertical thorns. Magnified 2000 diameters.

The rods of the enamel on an average are half the diameter of the columns of the basis-substance in dentine; therefore, four columns of the former will correspond to two of the latter, and consequently two dentinal fibers will answer to four enamel-fibers. Sometimes in the cross-section of an enamel-rod I met with roundish formations occupying the center of the rod, one or two in number, which, owing to a denser granulation and a surrounding shell, have the appearance of nuclei. The enamel-fibers run a very straight course toward the surface, and are here, in the average, a trifle thicker than near the boundary of the dentine.

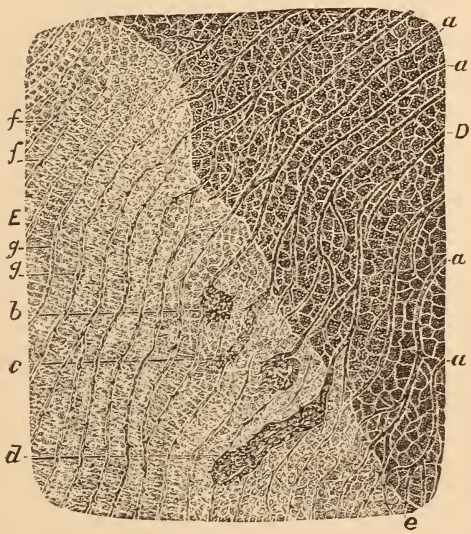
The outermost surface of the enamel is covered by flat epithelia (Nasmyth's membrane), which in the transverse section have the appearance of shallow spindles; not infrequently there also occurs a stratified epithelium on the surface of the tooth. The enamel-fibers are in connection with these epithelial bodies, which, if detached, show delicate offshoots adhering in regular intervals — the broken enamel-fibers. Sometimes the surface of the enamel is coated by a thin uniform layer of protoplasm, with regularly scattered nuclei. In such an instance single epithelia are not traceable, though scarcely any doubt can arise about the epithelial nature of this layer.

At the place of junction of the enamel with the dentine a direct connection is often seen between the enamel and dentine-fibers. The latter, through repeated bifurcations, being closely brought together, continue their course into the enamel-fibers without any interruption. The direction of the fibers of the two tissues, however, is almost never identical, inasmuch as the enamel-rods, and consequently the enamel fibers, as a rule, owing to their wavy course in this situation, are obliquely intercepted upon the dentine.

We can very often trace dentinal fibers up into the enamel in a

varying distance, without a distinct union between the enamel and dentine-fibers, as the former do not reach the surface of the dentine, but terminate above its level in different heights, while the zone close above this is occupied by a delicate, irregular net-work analogous to that of the dentine. Here no rods of enamel are visible either in longitudinal or transverse sections, but with low powers of the microscope only a finely granular layer is presented.

Fig. 10



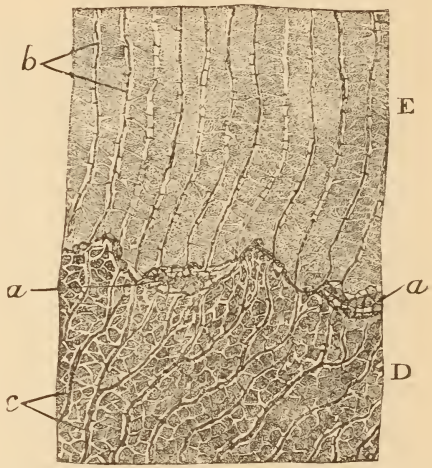
Union of dentine with enamel. *D*, dentine; *E*, enamel; *a a*, dentinal fibers, being in union with large protoplasmic bodies *b c d*. or directly running into enamel-fibers *e g*. The latter often are lost in the delicate irregular net-work on the bottom of the enamel *f f*. Magnified 1200 diameters.

In many places the dentinal canaliculi, upon entering the enamel, suddenly become enlarged, and form more or less distinctly spindle-shaped cavities of greatly varying diameters, analogous to the spindle-shaped enlargements on the boundary of the cementum. These enlargements run either in the main direction of the dentinal canaliculi or deviate obliquely. They invariably contain protoplasmic bodies, which plainly show the reticular structure, and sometimes contain one or more compact clusters to be considered as nuclei. The spindle-shaped protoplasmic bodies, on their proximate ends, are in direct connection with the terminations of the dentinal fibers which have arisen from their repeated bifurcations, while on the distal end they may show delicate fibers, viz., enamel-fibers, or delicate conical thorns, traversing the light space between the surface of the protoplasmic body and the wall of the cavity. These thorns are lost to sight on passing into the net-work at the bottom of the enamel. In some places, especially on the cusps, the spindle-shaped enlargements of the

dentine-fibers are quite numerous, and of an almost uniform size and direction, forming regular rows of spindles within the enamel. In the teeth of younger individuals, the spindle-shaped enlargements are comparatively larger and more regular than in the teeth of old people.

The boundary line between the dentine and enamel is either straight or slightly wavy, and with more or less deep bay-like excavations, analogous to those on the boundary between dentine and cementum. The concavities of the bays are directed toward the dentine. In this interzonal layer at the bottom of the bays we meet with fibers occupying the curved spaces between dentine and enamel, or we will see in a correspondingly bent direction protoplasmic bodies directly connected with the dentinal fibers downward, and with the enamel-fibers upward. In specimens stained with chloride of gold, the dentine is always much deeper in color than the enamel, hence the relations described are very plainly marked on such specimens.

Fig. 11



Union of dentine with enamel. *D*. dentine; *E*, enamel; *a a*, protoplasmic bodies on the boundary between both tissues, in union with enamel-fibers *b*, and with dentine-fibers *c*. Magnified 1200 diameters.

Results.

The details described from microscopic examination make it evident that we shall have to modify considerably the views heretofore maintained on the structure of the teeth.

Since we have known the structure of protoplasm, and that of basis-substance of connective tissue, by the researches of C. Heitzmann, we are accustomed to look for the distribution of the living matter not only in the protoplasmic bodies (the formerly so-called

cells), but also in the basis-substance, which for a long period was thought to be devoid of life.

Living matter has two main characteristic properties, viz., those of motion and reproduction. We observe contraction and extension alternately in every variety of protoplasmic formation, also the increase in size of living matter (swelling of the granules), both in the physiological process of propagation and in the pathological process of inflammation.

The net-work of living matter present in the basis-substance of connective tissue cannot, as a matter of course, be seen moving, but we observe very readily its increase after the basis-substance has been liquefied and the condition of the protoplasmic stage reëstablished, as in inflammation and new formations. In all these instances the chloride of gold is a valuable reagent for the purpose of staining the living matter in all its phases of development.

The structure of the tooth closely resembles that of bone. We know that the basis-substance of bone is traversed everywhere by a net-work of living matter, in the shape of beaded fibers, where they form larger offshoots of the protoplasmic bodies. In bone-tissue the presence of living matter is plainly demonstrable by observation of living and of chromic-acid specimens, both in physiological and pathological conditions.

Comparison of the tissues of teeth and bone shows that a tooth, as long as it is in connection with the living organism, is alive, and contains a great amount of living matter. The sensitiveness of all the tissues of the tooth, the phenomena of growth, the results of inflammation, etc., all strongly indicate the presence of living matter within the tooth, and this I have proved in fresh teeth, in those treated with chromic acid and stained with chloride of gold.

1st. The dentinal canaliculi are excavations in the basis-substance of the dentine, each containing in its center a *fiber of living matter*. Besides the dentinal canaliculi, there exists an extremely delicate net-work within the basis-substance of the dentine, into which innumerable offshoots of the dentinal fibers pass. Although we cannot trace the living matter throughout the whole net-work in the basis-substance, evidently owing to its delicacy, we are justified in assuming that not only the dentinal canaliculi, but the whole basis-substance of the dentine is also pierced by a delicate net-work of living matter. The living matter of the dentine is in direct

union with that of the protoplasmic bodies of the pulp, of the cementum and of the enamel.

2d. The cementum, as well as ordinary bone, is provided with lacunæ and canaliculi. The lacunæ contain nucleated protoplasmic bodies, and the canaliculi hold offshoots of the living matter of the protoplasm. The whole basis-substance of the cementum is traversed by a delicate net-work, which in all probability contains living matter, though this is traceable only in its thorn-like projections from the periphery of the protoplasm and its larger offshoots. The living matter of the cementum is uninterruptedly connected with that of the periosteum, and continuous with the living matter of the dentine, either through intervening protoplasmic bodies in the interzonal layer or directly with the dentinal fibers.

3d. The cementum covering the neck of the tooth is devoid of lamellæ and protoplasmic bodies. It is built up by directly ossified osteoblasts of the periosteum, presenting their prismatic shapes, and everywhere traversed by a net-work of living matter. This is in connection either with the epithelium of Nasmyth's layer or the periosteum, and with the dentine mainly through the intervening net-work in the basis-substance of the latter.

4th. The enamel is traversed by fibers of living matter located in the interstices between the enamel-rods. The fibers are connected with each other by delicate fibrillæ, piercing the enamel-rods in a vertical direction. Besides these rectangular unions the basis-substance is traversed by a minute net-work of living matter. The enamel-fibers send conical thorns toward the enamel-rods, and such thorns are visible in all interstices between the enamel-rods. The enamel-fibers are continuous on the outer surface with the covering layer of flat epithelia, and on the inner surface with the dentinal fibers. The latter connection is either direct or indirect through a net-work of living matter, or through intervening protoplasmic bodies in the interzonal layer.

REPORT ON HISTOLOGY AND MICROSCOPY.

By G. F. WATERS, of the Committee.

BY reference to the Transactions of the American Dental Association for 1877, page 43, discussion of Dr. Dean's paper on Dental Physiology, it will be seen that I referred to some strange appearances found within a cavity (in a section) of a tooth. Fig. 1 of the accompanying plate gives a view of this portion of the section enlarged forty diameters, and having some portion of the contents idealized at eighty diameters. This cavity was in the enamel, in the grinding surface of the palatal portion of the crown of the first left superior molar, and opened from a sulcus into which small particles of food, during mastication, were naturally forced; subsequent fermentation would displace some of the impacted mass only to be replaced again at the next meal. This series of operations had continued for forty years, when the tooth was extracted, so that the penetration of the enamel and formation of the cavity were very gradual.

As we look into this cavity we desire to know what and from whence are these curious bodies. In pursuing an investigation for the purpose of elucidating these questions, we naturally first look to the various kinds of food that have been ground upon the tooth, and in them we find forms that very nearly, if not exactly, correspond with those found in this cavity of decay; and we shall be surprised at the vast number and variety of the minute cryptogamous forms of life to be met with in all articles of food, particularly the fruits, nuts and roots. In the sweet potato I find forms developing before decay, resembling B (which is an enlargement of one of the forms found in the cavity in Fig. 1). They are dark but covered with spines more or less permeable by light, and having a length as to width of six or more to one. They appear before the mycelium of a well-known pencillium, and resemble it in no respect, and I trace no connection between the two, except that the spiny form seems always to precede the mycelium of this pencillium.

This mycelium is hyaline, smooth, of indefinite length, with many fine branches, and seldom exceeds the tenth of a milli-

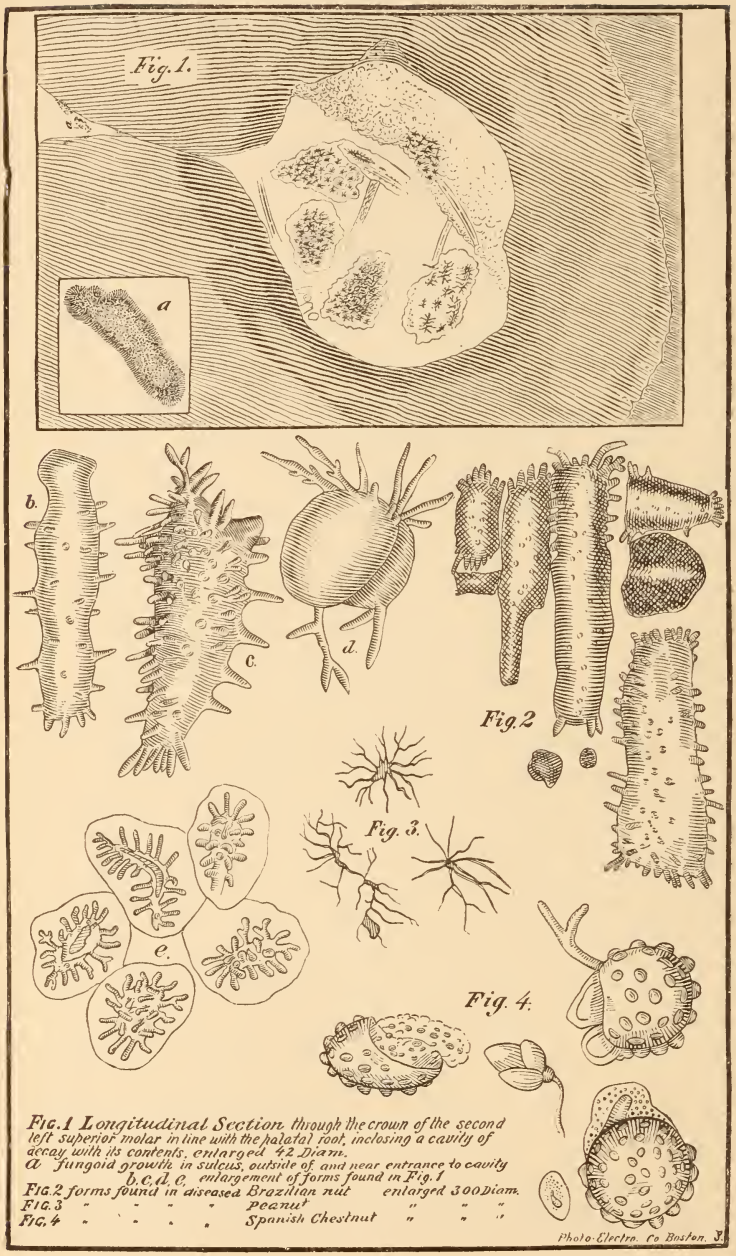


Fig. 1 Longitudinal Section through the crown of the second left superior molar in line with the palatal root, inclosing a cavity of decay with its contents, enlarged 42 Diam.
a fungoid growth in sulcus, outside of and near entrance to cavity
b, c, d, e, enlargement of forms found in Fig. 1
Fig. 2 forms found in diseased Brazilian nut enlarged 300 Diam.
Fig. 3 " " " " Peanut " " "
Fig. 4 " " " " Spanish Chestnut " " "

meter in size. In growing, their course is between the cell-walls of the starch-grains, thus causing an old wilted potato to stiffen up and appear quite fresh. As they progress, sporidia-bearing filaments penetrate the starch-cells, changing their contents to carbonic acid, water and sporidia. Then, by the rupturing of the starch-cells, the potato suddenly becomes soft and is soon covered by white spore-bearing filaments, in which condition it presents the appearance of the body found in the sulcus in Fig. 1, marked A, enormously magnified, an enlarged view of which is given in the white square on the enamel. It will be seen that the potato may be considered good food, whilst largely composed of fungoid forms, mycelium and sporidia. When the potato is cooked,— more especially when baked,— the part infested by the fungi will be found harder and darker than the other parts, and also to give off a peculiarly disagreeable odor. Heat, sufficient to cook the potato, seems to destroy the vitality of the fungi, so that when thus eaten, they do not seem to disturb the digestion.

What I have said of these forms of fungi in the apparently healthy potato, M. C. Cook, in his "Rust, Smut, Mildew and Mould," has said of many other articles of food which I have been in the habit of eating (as the sweet potato) uncooked. Apples, pears and peaches have — in addition to the forms alluded to above which grow within — other forms growing upon their surface, allied to lichens. In the beet, turnip and onion, whilst in an anticarious condition, fungoid forms were discovered resembling some of those found in this cavity, but which are not here illustrated. The castana or Brazil nut showed a large variety of fungi. In one of these, microscopic truffles, or bodies resembling the truffle, were found packed solidly throughout the entire mass. When placed in water, a hyaline mycelium was developed, giving them when magnified the appearance of D, in the plate.

Fungi were also found in this nut having red mycelium, others with yellow mycelium, and others still with white mycelium. Some nuts were examined in which the meat had been changed, apparently by fungi, to palmic acid. Other crystalline forms were present that gave under polarized light a varied and most beautiful appearance, such as feathers, fleecy clouds, tropical palms, and the frost-work upon the window-panes,— all most brilliantly rainbow-tinted. One portion of this nut, mounted for the microscope, gave,

when magnified three hundred diameters, the forms seen in Fig. 2, which are not unlike in appearance B and C,— the latter being enlargements of forms observed in the cavity of decay in Fig. 1. The mites which infested many of these nuts were destroyed in large numbers, at a tender age, by a red spore fungus which had a yellow mycelium. I found red sporidia of this fungus both in eggs, and young mites in the sacculated stage. The adult mites seemed free from them. The full-sized sporidia were as large as human blood-disks, and seemed filled with minute spores not more than the fifteenth of their diameter.

The Pecan nuts examined had, with but few exceptions,— and in these the meat was bitter,— the mesocarp packed solid with the spores of a red fungus containing a very large percentage of tannic acid. From less than a pint of the shells I obtained over two ounces of tannic acid of a bright ruby color. The mycelium of this fungus in its development in an open vessel, when kept at a temperature of 98° Fahrenheit, gave off fumes of acetic acid, and upon the addition of a small amount of aqua-ammonia the fumes were rendered exceedingly pungent, resembling those of nitric acid. In some of these nuts the red fungus was absent, but another was present with forms exactly like those in Fig. 3, which were found in the peanut. All the same forms were also found in the little red checkerberry, *Gaultheria procumbens.*

All of the single forms infested by fungi had this ray-like appearance. The English filbert exhibited three forms of fungi growing within it,— one constantly present growing within the substance of the cotyledons, the mycelium of which was so minute as not to be traceable in a microscopic section, but when sown in a tumbler of water it developed with great rapidity and formed a net-work throughout, giving it an opalescent appearance. In a short time a dense film formed upon the surface, which gave off a highly offensive odor. It was whilst experimenting with this fungus that I was six times prostrated by typhoid fever, or a fever resembling typhoid, which yielded quite readily at first to an abortive treatment, consisting of an internal exhibition of bisulphite of soda and carbolic acid combined. Subsequent effects, however, compelled me to give up the further study of this fungus.

The other fungi developing between the pericarp of the cotyledons merit a passing notice. One of them resembled minute

cocoons of a lepidopterous insect, being minute globes composed of yellow mycelium and containing within red spores. The other showed red mycelium with long club-shaped spore heads with spores growing in sulci upon it. All the spores in this nut were very much smaller than those found in the Brazil or the pecan nut. The forms illustrated on the plate at Fig. 4 were found in the Spanish chestnut, and exhibit the minuteness of the spores, and also show their gradual development as well as the commencement of the growth of mycelium. One body, centrally situated, shows the development of spores by gemmation. Other forms show the development of spores by septation. The spores in two cases are seen escaping from the sporidia.

M. C. Cook, in his account of the British fungi, says that the cryptogamous, unlike the phanerogamous plants, give off carbonic acid and absorb oxygen. We generally recognize such to be the case with some of the ferments, while others give off acetic acid, as was the case with the fungus found in the pecan nut, and as also is the case with the "mother" which grows upon the surface of cider when exposed to the air. There are facts which seem to show *that the only limit to the acid products of these bodies,— the fungi,— is the constitution and condition of the substance in which they find lodgment and are capable of developing.* The vast number of these bodies may be inferred when it is known that mycologists at the present time, with a liberal allowance for hair-splitting, reckon among British species of flowering plants only one-fourth of the number of the fungi alone, not to mention ferns, mosses, algæ and lichens. There are strong reasons for believing that carbonic oxide is also developed by some of these low forms of vegetable life. Would it not be proper to call them vegetable deaths? It is not clear to my mind that any of these, if left, would multiply for any length of time at the expense of the tooth, but it is perfectly clear that many of them have been introduced with particles of food, where by their presence they have exerted an injurious effect upon the tooth substance, in that they have acted to decompose the food with which they were associated, if not also to decompose portions of the tooth.

It is well known that in all fermentable substances, fermentation is started by the presence of an azotized body; that the fermentable substance changes and has formed within it, as a result of this

fermentation, some acid; that fermentative changes take place with varying rapidity, according to the more or less favorable conditions of temperature and moisture; that the buccal cavity is, in a normal condition, most highly favorable to such changes; that all foods are more or less infested by some form of fungus; that the air is, to a great extent, at the sea-level, and over most of the earth's surface, so impregnated with cryptogamous spores (and all cryptogamous spores are nitrogenous); that foods can only be kept from fermentation for any length of time by destroying the azotized bodies with which they are in contact, by the application of a temperature sufficiently high to destroy all such life, or by combining with them certain chemical agents. It is also well known that all foods not so protected against contact with azotized bodies will, in the presence of sufficient warmth and moisture, be liable to destructive fermentation. Hence it may be seen that wherever there are imperfections in teeth, or places where a lodgment of food or fermentable matter may occur, there will be liability to the formation of acids, and of course to the solution of lime-salts in the contiguous portion of the tooth. So that all imperfections that cannot be so filled as to perfectly secure them from further lodgments should be so shaped as to readily be kept clean by friction. Teeth with soft enamel will naturally be the most difficult to preserve by filling, as in such teeth the crystals of enamel are more loosely put together, the spaces between them more easily penetrated by foreign substances; and a greater difficulty will be found in coapting the filling, of whatever nature, to the surfaces of such teeth than to the surfaces of the more dense and perfect. And it will be understood that the softer and more pliable the filling material, the more readily will it pass into the inequalities of the surface, and hence more perfectly protect it. But it happens, most unfortunately, that of the substances used for such filling purposes, the one most stable is the most difficult to adapt perfectly to the minute inequalities of the walls of a cavity.

With these facts in view, it is not necessary to consider gold as "incompatible with tooth-substance" in order to account for the failures which in certain cases have been attributed to it. But this difficulty attending the adaptation of gold to the walls of the cavity is easily overcome, for nature has not left us without a fitting substance to fill these minute scratches and imperfections of soft

teeth, to the entire exclusion of the minute spores we have had under discussion. This substance will no more sustain the life of a fungoid spore than will carbonic monoxyde the life of a human being. It is pliant, inodorous, tasteless, non-oxydizable, non-volatile, non-irritant even to the pulps of teeth, by which it is readily absorbed, inducing in them the highest functional activity compatible with comfort to the individual. This substance is vaseline.* With the aid of vaseline the dentist will now be enabled to save the soft teeth as readily with gold as he formerly did those of a denser structure.

My method of using this material is as follows:

After having prepared the cavity for filling by the removal of débris and carious walls, and by properly shaping it, I destroy the low forms of life in the walls of the cavity, so far as I am able, by the use of a saturated aqueous solution of carbolic acid and a saturated aqueous solution of bisulphite of soda, singly or combined. I then dry the cavity with bibulous paper, and with a small wad of the same rub into its surface the vaseline, leaving a superabundance in the cavity until I am ready to fill. I then wipe the cavity clean, just as the steel and copper-plate printers do the face of the plate when about to print from it. And just as the ink is retained in the lines and scratches of his plate, so will the vaseline be in the porous enamel and scratches in the dentine, to the exclusion of other foreign matter.

DISCUSSION.

Dr. Spalding: The conclusions to which Dr. Black in his paper has arrived are particularly grateful to me, for the reason that they coincide with my own previously formed views on the subject. The investigations and observations of the author confirm my theoretical views. It is a subject which is of great practical importance,— one which has been largely studied before, but, so far as I know, there has never been any positive illustration of it that compares with what we have had this morning.

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* Vaseline is one of the products obtained from petroleum by repeated filtration through boneblack, according to a process patented by Robert A. Chesebrough, and furnished by him to the profession, without a royalty.

I consider it one of the most valuable papers we have had, settling, in my mind, many disputed questions, especially that with regard to the lateral proliferation of the odontoblasts. It shows the process by which dentine is originally formed, and by which it is subsequently formed as age progresses and the capacity of the pulp is diminished. Light is also thrown on the subject of the formation of what we call secondary dentine.

Dr. BUCKINGHAM: I want to say something on the subject of Dr. Black's paper upon Dentine. From examining authorities, carefully comparing one with another, I have come to certain conclusions with regard to the production of dentine that I wish to present to the Association, and these are different from some views already advanced. I intend, in the discussion, to jump from one point to another as rapidly as I can, but I want to get a firm foundation to start from.

The first formation of organized tissue is the cell. One would suppose that this has been admitted so long that there would have been some definite idea of its form and nature, but, unfortunately, you will find that the views of different authors in regard to what constitutes cells and their functions are as various as the authors who write upon the subject. I do not wish to examine and compare the different views, but we must have some starting-point if we wish to understand each other. Virchow describes a cell to be a sac filled with fluid; Beale describes it as a mass of germinal matter, which afterward becomes hardened on the outside. This process of hardening gradually goes on until the germinal matter occupies but a small part of the cell. The hardened portion he calls formed material, which has lost the power of reproduction, but retains the functions of living matter. These cells are the basis of all organized tissue. Examine an organ where you will, you will find it is composed of cells. The smallest form of animal or vegetable life is a simple cell,— the monad, a simple sac filled with a fluid. It has the power of digesting its food without a stomach; to discharge it without a vent. It moves without muscles, feels without nerves, performs all the functions of life, and has the power of producing "*cells similar to itself.*" In regard to size, Beale has measured cells down to the one hundred thousandth of an inch, and others have been described as large as the one hundred and twentieth of an inch. Take them at their largest

you will find them extremely small, yet it is in these little workshops that nature produces material to build up all organized tissue, just as in the inorganic world she is working with atoms to build up mountains.

Cells multiply in different ways. Some have one or more nuclei, which go to form other cells; some multiply by budding, and others by segmentation. Beale thinks that the smallest portion of this germinal matter may separate and form cells, but both Virchow and Beale state that a cell must come from a parent cell. Cells sometimes multiply with great rapidity. In some vegetables they will produce almost millions in a short time. At this point I want particularly to state that I understand Beale to divide cells into two parts: "the formed material and the germinal matter." The germinal matter alone has the power of producing new cells. The formed material has the functions and action of life, but not of creating a new cell. At first the cell is all germinal matter, and after a time it becomes hardened on the outside. This hardening process continues until the germinal matter, in many cases, occupies but a limited space. The germinal matter gives life, and the formed material gives form. I don't want to elaborate further on this point, but I want to state that cells produce cells similar to themselves, and yet, where there is a necessity for a new organ, there appears to be a special cell created for the purpose, and afterward it multiplies until the organ is produced. I do not know that there is any case in which one tissue will produce cells to build up another tissue different from itself. The old theory was that plasma was thrown out, granules formed in the plasma, and these formed cells, so that there was a spontaneous generation.

We are told in the books that the enamel is produced from the enamel-organ, and the dentine from the pulp. Would it not be more rational to suppose that, when one enamel-cell was formed, it would have the power of forming others, and so likewise with the dentine, and not create a special organ for the purpose of producing a tissue dissimilar to itself? The theory of the elder Tomes was, if I understand it correctly, that there was first a papilla, then a dental groove. The papilla is composed of nucleated cells. After a time the papilla is surrounded by a follicle, which eventually becomes a sac and incloses the papilla. The inner portion of this sac separates from the papilla, or pulp, as it

is now called, and the intervening space is filled with a soft, gelatinous mass, in which the enamel is formed,— the pulp being the part which produces the dentine. This production takes place by the development of cells, which arrange themselves so as to form tubes. The description given of the development in the more recent works is that there is an inflection downward of the epithelium, forming first an open sac. This becomes the enamel-organ, and in it the enamel-cells are formed. These cells arrange themselves in a columnar form, and so form the enamel-rods, each rod being composed of a number of rods joined together. Beneath this enamel-organ the dentine is formed by the dentinal pulp becoming converted into dentine. To this point I take exceptions. I think it would be more rational to suppose that after the first dentine cell is formed, it becomes the parent of the others. I would have it that these arranged themselves to form the outer layer of the dentine, and, following the process described by Beale, of becoming hardened on the outside, the germinal matter is continually pushed toward the pulp, leaving behind, in fully formed dentine, a mere fiber. By this theory we can understand how one cell can form the whole tube and a series growing together would form the dentine. These cells having, in their downward growth, to occupy a continually diminishing space, may and do unite, and thus form the branching of the tubes. I do not believe that these cells, or odontoblasts, as they are called, are part of the pulp, or that they are even formed by the pulp, but they grow from a parent cell or odontoblast developed by some process not understood. If this theory is correct, the pulp cavity is lined by a series of these dental germs or cells, which grow inward toward the pulp until the tooth is fully developed, leaving behind them a fiber of germinal matter. The outer portion of these cells hardens and becomes the dentinal cartilage, in which the lime salts are deposited. These cells always exist in a living tooth after full development has been obtained, but their growth is arrested by some process of nature, and remains stationary unless excited by reason of some irritation, when a second growth takes place, forming what is known as secondary dentine. I do not think that the pulp has anything to do in its formation further than to carry pabulum to the cells.

Dr. Atkinson: The writings on this subject in the text-books that have been published to the world, and are more than ten years

old, you are wasting your time and energies to deal with at all. Men who have been the workmen in this direction have in the main worked separately. We have an eminent example of this in the beloved brother from Illinois, who shows conclusively that he has been working earnestly, but he has been crippled by the abominable heresies of false doctrine that he has found in the books, and, thank God, he has kicked against it, though he has got somewhat entangled in it. Professor Spalding said the report of Dr. Black nailed the growth of the dentine clearly, and proved that the steps he took were sound. His specimen did not prove that there was no presence of odontoblasts, and that there was a successive generation of them. There were many suggestions and dogmatic statements in the report that would consume more than the time allotted me to consider in detail.

I shall not refer you to incorrect diagrams and badly manipulated specimens. We are easily befogged by such means. Any other diagram than one which is true to the fact in nature I hold to be a subterfuge. A good deal has been said in the various papers with regard to "epithelium" and odontoblasts. As you love the truth, don't say "cell" again, not even after the description given by the last speaker. Cells are vegetable products. There is not a cell in the human body, only so far as they are vegetative in their nature. Crystals belong to the mineral kingdom; colloid bodies, or corpuscles, belong to the animal kingdom; and in the definition of a "cell" that you heard a few minutes ago, the ordinary description of an "amœba" was presented to you; which is the first form of animal existence, and is represented in this diagram as a colloid body heretofore supposed to be without differentiation; but that theory has been exploded by Carl Heitzmann.

[The speaker here explains a cut or diagram representing the differentiation of the body referred to, and also refers to other diagrams, which description cannot intelligently be reproduced.—Reporter.]

Dr. McQuillen: The subject of Histology, as far as my own brain is concerned, is a little mixed, for we have had so many papers, on such diverse subjects, that it is a little difficult to know what to take up. We were informed this morning, by my friend Dr. Atkinson, that some very startling discoveries had been made

by a gentleman in New York. I do not wish to question that he may have made some discoveries, but I cannot, after listening to the reading of the paper, recognize the wonderful nature of the discoveries which we were promised. My friend will agree with me as a microscopist, that when a paper is presented before a microscopical society, we should demand not diagrams but specimens. We want to see for ourselves. Diagrams will not answer. I am glad to know that the gentleman is at work with the microscope. If he has not discovered, he may be on the road to a discovery; but I want to say in regard to that modest man from Jacksonville, Illinois,—Dr. Black,—that he has been making some very excellent specimens; and he showed us specimens at Chicago, last year, some of which are now under the microscopes on the table, that reveal structure claimed as new and original discoveries in the paper read, if I understand it aright. In making investigations, a man comes across something he thinks is original, which, on examining the literature, he finds had been discovered and presented to the world long before. In the experiment, described to you last evening, on the pigeon, I thought I had been the first to keep a bird alive, after the removal of the cerebrum, for a month; but on examination found that some one had preceded me in that matter. In original investigation it is important one should be thoroughly familiar with the literature, in order that he may not claim as new that which has been already placed on record.

Dr. Black: The time of this Association is so fully taken up, and we have so much work yet to do, that I have hesitated to say anything more upon this subject, but having been called upon, I will say a few words. I did, some years ago, prepare some specimens, practically in the way referred to in Dr. Bödecker's paper, that seemed to me to show those things, or a large portion of them, that have been mentioned. I had no special thought that this was a new thing. I do not know that I thought of it in that manner particularly; but one thing I did think about it,—that it showed a good many things that we have not been able to see by the ordinary modes of preparing specimens; consequently I was very glad, when this subject came up in the form that it did, to hear the expressions of others in regard to it, and their experience. But there is another feature in this paper, entirely different, perhaps, from this, which does not necessarily hinge, as I think, upon the

mode of preparing a section, and that is, the engrafting of Carl Heitzmann's protoplasmic-string theory into our conceptions of the histological structure of the hard tissues,— the dentine, enamel and cementum. Well, something of this kind may be seen there, but this is certainly a theory that we should be a little slow to adopt. If there be anything new in the paper, it is this point. I do not know that there is anything else that I saw in the drawing that is particularly new—that I have not seen; and I suppose other microscopists have seen the same. Others have prepared sections practically in the manner described in the paper, besides myself, although the author may have known nothing about it, but I did not suppose it was new. I want to speak of one thing in regard to the enamel-organ, that others may notice it, that some understanding may possibly come from it in the future. It seems to bear the same relation to the developing tooth that the white of the egg does to the chick,—being a store of material for the building. Take the enamel-organ of a developing tooth, say at five months, drop it into gum arabic for fourteen hours, place that in alcohol, and after a few days draw it out and cut it into sections, and you will have the whole enamel-organ in its perfection,—precisely in position and but little shrunken. Take the same thing, drop it into a very mild solution of acid, and then carry it through the same process, and there will be no enamel-organ there.

The removal by the acid of the lime salts stored for the building of the enamel has so changed the osmotic properties of the contents of the organ, that all has been removed and the organ collapsed.

One word as to the epithelial cord of the permanent teeth. We have been taught that it arises from the cord of the temporary tooth. While this is generally true, it does not seem necessarily so, for I have observed that it sometimes arises directly from the epithelial lamina. I have in my collection a number of sections which show both the cords of the temporary and permanent tooth, —each proceeding separately from the epithelial lamina to their respective germs. The facts seem to be that the cord for the permanent germ may arise from any point on the cord of the temporary germ, or directly from the epithelial lamina, there being no absolute rule.

Dr. Dean: I have seen some specimens of Dr. Black's, in which

it certainly seems that the cord of the permanent follicle comes from the epithelial lamina of the mucous membrane; but the theory of Tomes, Kölliker, Magitot and Frey is, that it comes directly from the epithelial cord of the temporary teeth,—that is, for the twenty permanent teeth.

Magitot believes that in all cases the cord of the permanent teeth,—excepting the first molar, which emanates from the epithelial lamina, the same as the temporary teeth,—he believes in every case they start out from this epithelial cord, and as the sac (or the follicular wall, as he calls it,) rises above and incloses the bulb and enamel-organ, it cuts off this cord; so that in all cases, if you examine the fœtus about the sixteenth week, after the epithelial cord of the temporary tooth is thus severed, the enamel-organ of the permanent tooth, which in reality originated from the cord just severed, will have the appearance of originating directly from the epithelial lamina; although he states that it does not start from any particular point upon this epithelial cord of the temporary follicle. He has figures, however, which would indicate, to my mind, that sometimes the cord arises directly from the follicular sac.

For the first permanent molar the epithelial cord arises from the epithelial lamina, in the same way that the cord of the temporary tooth does; and when you come to the second molar, this arises from the cord of the first molar, and the third molar arises from the cord of the second molar. That is his idea of that matter.

Dr. Atkinson: There has been so much misapprehension of the use of terms, that it would be in vain for me to try to straighten the matter out. There has been seemingly a sort of feeling that there could be a reason in any man's mind to make a statement that did not seem to be true to him. I want to say that, of all the men I have ever met in my life, histological students are the pink of perfection for honesty in stating what they see, and they are the most willing class of men to rectify any misapprehension that I have ever met. They are simply dogmatic when they have studied alone, and have not had pupils enough to correct their apprehensions. If a man feels that he knows his subject so as to be beyond error, all he has to do is to get a class of pupils that will witness the same experiments that he does, and they will very soon

enable him to rectify any mistake. As to the question with reference to what I said was in Dr. Bödecker's paper, either the gentleman meant to call me out to explain more fully, or he was so inattentive that he paid no heed to what was in the paper. I stated that it was but the synopsis of one that was preparing upon that subject, and that it will recite all the authorities from the earliest time until this present day, and in that recapitulation make a statement of the failure to have found anywhere the interpretation given by Heitzmann in the first place, and by Bödecker in the second place; and all that I claimed to be new was the discovery in the enamel of what has been called "Max Schultze's Thorns,"—that is to say, protoplasmic strings in the enamel of a lady's tooth, who was forty-five years old, shown without any decalcification at all (ground down while in a perfectly natural state, and as soon as possible after it was taken out of the mouth), and from which these drawings were made, that are correct and faithful representations of veritable objects.

What is new to-day? That all the tissues are connected by protoplasmic strings; and Carl Heitzmann was the first man who pronounced that, as far as I am aware.

How do amœba move? We have been told all the way through that an "indifferent substance" was enabled to project the movement of all the animal bodies; that is to say, that they were able to perform all the functions of body without a single organ. That, Carl Heitzmann has set to rest, for he has shown us that the manner by which an amœba does move is to throw out, by the elongation of protoplasmic strings, a portion of its jelly-like body, and make what they call "pseudo-poda," the portion by which it seizes upon the slide or cover, and thereby, by the process of suction, make fast to that, as we boys used to lift a brick with a wet leather disk.

I do not claim that the idea of the interglobular masses being connected with the dentinal fibrils is new. I have known of it since I have known microscopy at all. What is new in this direction? Principally Carl Heitzmann's discrimination and interpretation of protoplasmic granules and strings, which he demonstrates with a power of from five hundred to one thousand linear. It is not that teeth are not produced to-day as they were formerly, but that we are more earnest seekers for truth.

How many kinds of amœba are there? One authority recognizes six distinct kinds. What is the first kind? It is a non-nucleated amœba — a lump of jelly that is so small that it requires great patience and much skill, with very high powers, to discover the protoplasmic strings in its body at all, and there is no other differentiation in it. Then we have the nucleated amœba, with one nucleus, and then two, and three and four, and after four they are called polynucleated. I should be glad to go through the books and show what is old and what is new, but we can wait.

Dr. McQuillen: My friend says the microscopist sees before him what is offered to his eyes. That is true, but in investigations in any department of science, men start out frequently with preconceived theories, and that which they see before them they very often interpret in favor of that theory. Men starting with preconceived opinions often see only the things that corroborate them, and overlook or ignore facts that would oppose the hypothesis. There are two methods pursued in science: one of reasoning inductively from cause to effect; the other deductively, or looking for the facts to corroborate an hypothesis. Scientific men generally pursue the former as the safest course. The adoption of both methods, in some instances, is invaluable, the one confirming the other. As has been said, it may be that Heitzmann's theory is projected into this paper; on this point, however, until I have an opportunity of carefully reading the paper and examining the specimens, I do not wish to express a positive opinion.

There is no reason why we should be confined to the authority of books. Owen, Kölliker and Tomes are valuable in showing what has been done, and are entitled to respect as authority; but we should not be content to see with their eyes alone. Every person in the Association has a pair of eyes and a brain, and should learn to use them in examining the page of nature and reading the truths there presented. The expense of a microscope may be urged as an objection. A serviceable and effective instrument, made by Zentmayer for about sixty dollars, has been shown to you to-day; it would answer your purpose to begin with. The one thousand and fifteen hundred dollar microscopes are too often but costly toys to their possessors.

REPORT OF COMMITTEE

ON

PATHOLOGY.

By W. H. ATKINSON, Chairman.

PATHOLOGY is conceded by all to consist of arrest or deflection of physiological or harmonial functional movement.

It will be in vain to pursue this subject without some statement of the activities, a derangement of which constitutes the mode of function denominated pathological.

Physiology is generally defined to be the nutrient operations of the body as a whole, and of the organs as special manifestations of function. Neither of these, however, is capable of revealing to us the changes that constitute the production and maintenance of these factors of nutrient activity. Systemic and organic activities are but mass presentments of function as aggregates of tissual and molecular changes — occult, indispensable prerequisites to these commonly recognized examples of function.

Molecular changes depend upon the engagement and disengagement of bonds of energy belonging to atoms of which the molecules are composed. The production of water, for instance, depends upon the mergence of two gases into one fluid, by the engagement of definite measures of energy, symbolized by the type of a molecule of water (H^2O) in chemical nomenclature. Any other combination of hydrogen and oxygen would present us with a different molecular body. Again, combustion of vegetable and animal substances will always produce water as one of the resultants of the change of molecular relation.

Physiology may now be more accurately defined to consist of REGULATED COMBUSTION OF PABULUM, UNDER THE GUIDANCE OF TYPAL DEMAND, and pathology as a *conflagration of pabulum*, UN-

DER THE CONTROL OF THE FORM OF MOLECULAR AFFINITIES DENOMINATED CHEMICAL. This last has long been recognized as the process of INFLAMMATION, to which we will now direct our attention.

The gradual growth to higher and better interpretations of the phenomena of inflammation, as displayed in the works of John Hunter, Virchow, Rèmak, Billroth, C. O. Weber, Von Recklinghausen, Conheim and Stricker, not to mention many others, are proofs of the want of complete satisfaction with which each has looked upon the labors of his predecessors and co-workers, as well as upon his own efforts.

Till this day it is impossible for the best observers to designate the point at which *physiological* activity becomes *pathological.* It is at least an entertainable proposition that some of the normal operations attendant upon the ripening of ova and spermatozoids are properly classifiable as inflammatory activities.

Histological research has shown the "corpus luteum" to be composed of scar tissue, of a like character with scars resulting from traumatic and inflammatory lesions. Excess of blood-plasm in any locality is liable to be converted into embryonal corpuscles, or mucous globules, as the indifferent basis from which normal and abnormal products arise, according as the environment tends to lead to one or the other. Simple hyper-plasia tends to increase of the normal tissues. When the blood-tracts are obstructed, and the press of the currents great, stasis, exudation and retrogressive molecular changes take charge of the exuded blood-plasm, and convert it into the products of the inflammatory process, which this retrogressive metamorphosis constitutes.

Late histological discoveries strongly indicate that *nerve-currents* and *blood-currents* are necessary conditions to allow inflammation of any territory. Those territories, therefore, that are not supplied with blood-circulation and nerve-currents are, if unaided, incapable of repairing their wounds when traumatically induced. When the neural and vascular currents are coetaneous and unobstructed, it is doubtful if any mere acceleration could result in the inflammatory process; but when the heart's action is too great to exactly balance the tonicity of the capillaries supplied by the nerve-currents, obstructions are readily induced in the tortuous channels of the capillary system.

To prevent the inevitable advent of inflammation under such circumstances, the obstructions must be removed, and the simultaneousness of nerve-currents and blood-currents be regained. The simplest method of accomplishing this desirable end will be to call the part into vigorous exercise by voluntary or involuntary effort of the subject, or by "massage," the manipulation of another person. The only reason why all inflammations might not thus be successfully treated depends upon our inability to cognize the departure from health at this early stage and to get at the locality.

Swelling, redness, heat and pain have universally been grouped together as the definition of the inflammatory process. No one has put on record even an approach to a legitimate, clear and satisfactory statement of the precise difference between normal nutrient function and its derangement, called inflammation.

Let us examine the process of conversion of pabulum (protoplasm) into the elements of tissue, and learn, if we may, that pleasure and pain, health and disease, are qualities or modes, and quantities or measures of functional activities, that vanish into each other by disturbing and restoring the balances of regular molecular changes. To comprehend these we must cognize the existence of atoms, of which the molecules are composed; and to understand the manner of the coming together of the atoms to construct the molecule, we must take into consideration the static and dynamic aspects of the atoms, no less than the awakening and engagement of the definite measures of energy that effect the combinations. Why and how the molecules move are the two questions the correct replies to which shall reveal to us the complete explanation of all functional movements, and declare how they are produced and maintained or destroyed, in functioning bodies.

Pain is the result of obstructed sensory nerve-current; *swelling* supervenes upon obstructed vascular current; *heat* is resultant upon obstructions in the neural and vascular channels, by which the mechanical movements of the masses of nerve-blood and vascular blood (through impact against the points of obstruction) become changed into molecular movement, which we then cognize as *heat.* These three, namely, pain, swelling and heat, *are the only essential factors* or necessary concomitants in the process of inflammation. The redness that has heretofore been made an equal factor is a mere incident, as is proved by the fact that some swellings are white.

What, in the next place, are we to understand by quality or mode, and quantity or measure of function? And how are we to differentiate these predominant aspects of the complex presence we nominate function of mind and function of body? The function of mind consists of seriated arrestations and releases of the tensions of consciousness or of the power of perception. The functions of body are also seriated successions of arrest and release of tensions of molecular and atomic bodies, through which the energy operates to produce molecular, granular, corpuscular, tissual, organic and systemic forms of function in their various manifestations.

Late works on chemistry assert that heat is given out or produced by combinations of atoms, and is taken up or quenched by separations of atoms. Works on physics tell us that "heat is a mode of motion," and that mechanical motion upon being arrested is converted into molecular motion, which is heat." How, then, are we to account for the heat set free upon the admixture of sulphuric acid and water? How does the friction produce the heat so largely by the mere rushing of the molecules of water among the molecules of acid?

The partially engaged, unsatisfied or sleeping bonds of affinity belonging to the atoms in the molecules of water and acid are in a state to be easily aroused into active motion, by any impact of current within the sphere of influence, be it direct or oblique, simple or manifold, in its advent. We understand the diffusion of water-molecules and acid-molecules to result from the desire to attain equidistance from each other in the mass of fluid; and the rush to acquire that tension effects the awakening of the sleeping bonds of energy, which, being set in motion, manifest the intense measure of heat always attending this experiment.

The difference between this process of disengagement of heat and that form attendant upon the inflammatory process in animal bodies, consists in the greater complications of engagements and disengagements of bonds of affinity in the molecular mass in which these changes occur; and the greater freedom of the fluid in the vessel of the chemist, as compared to the confinement of molecular mass in the tissual interspaces of animal organisms. There is also a larger number of elements entering into the molecular mass, which is the basis of all animal forms of metamorpho-

sis, than in the mass composing the vegetable or mineral examples of molecular aggregations. Hence the increased opportunity for the display of greater varieties of molecular changes that split up and minify the thermal and other currents possible to this limited territory.

There is such a thing as having the receptacle of molecular mass so packed with molecules as to preclude any motion among them. This has been proven by the stoppage of fermentative action by the pressure of a given number of atmospheres. Take the example of a fermentable substance placed in an air-tight transparent vessel; exhaust the air by the air-pump, and then inject pure oxygen into the receptacle containing a quantity of yeast taken from the tub, fresh and active. At first, bubbles of carbon-dioxide (carbonic acid gas) will break and rapidly disperse into the vacuum above the yeast, and there being no free oxygen present to support the fermentation, molecular change ceases to appear. Now admit pure oxygen in a small quantity, and the fermentation is again set up with increasing activity, in the ratio of the quantity of oxygen supplied up to a given measure. So soon as the tension or pressure of the incoming current of oxygen shall interfere with the freedom of the oxygen molecules in the space above the yeast, the activity of the fermentative change gradually lessens and finally ceases altogether. When the compression of the oxygen is great enough to arrest the motion of the oxygen molecules, they assume a static condition, preventing further changes between the oxygen and the hydro-carbons of the yeast. The yeast in the vessel is now in the condition of a "pop-bottle," or a bottle of "mineral water," fully charged with carbon-dioxide. All that is requisite to reëstablish the fermentative activity is to take off the pressure from the gas above the yeast in the vessel by giving it vent, so that the molecules of oxygen may be free to move among each other again, and then the attraction between the oxygen and the carbo-hydrates of the yeast-mass is at once set vigorously at work generating molecules of alcohol and carbon-dioxide out of the already existing albumen, glucose or diastase in it.

The alternate combination and separation of atoms, to construct the varieties of molecules in the mineral, vegetable and animal primates of bodies, is repeated and amplified, magnified

and minified, by the necessities of *the types of the individual presence*, in the various crystals, cells and corpuscles that are the characteristics of the three kingdoms known to exist as planetary presentments. A serial order of appearance and disappearance (or coming from without and passing beyond the range of our sensuous perception) pertains to the origination, growth and decline of every example of individual body or class of bodies, be they mineral, vegetable or animal. The chaotification of these gives the foundation from which all human functional capabilities originate; so, to understand all the activities possible to human bodies, we must become acquainted with the activities of the whole universe, of which man is the epitome.

"The whole is equal to all its parts,"—is an aphorism in the study of inflammation as true as it is in mathematics, astronomy and physics. The combustion of hydrogen and carbon with oxygen is well known to produce *heat*. Friction also produces heat to the degree of ignition of combustible substances. Are we not then justified in assuming that the heat of fever and inflammation is also the product of combustion? Does not this indicate that whatever prevents or arrests combustion will also arrest fever and the inflammation upon which it depends? The difference between fever and abscess is the difference between the combustion in a charcoal pit and in an open fire. The first extracts the hydrogen from the combustible substance and leaves the particles of carbon in their undisturbed position in the charcoal or the coke; the second oxidizes the carbon and hydrogen, converting them into carbon-dioxide and water,—both of which conspire to change the mineral constituents of the wood or coal into the salts of which their ashes are composed.

If we desire to understand just what fever and inflammation are, we must comprehend the process of combustion. Combustion is the undoing of the work of the sun, which constructs mineral, vegetable and animal tissues. How does this occur? Simply by the influx of an energy that enables the oxygen to disrupt the bonds of affinity, which "clamp" the atoms in the molecules, and the formation of other molecules by the use of these "clamps" in a different order of engagement of bonds. . . . Multivalent atoms are those which have many bonds engaged. We may conceive that these are placed in the "center," or "skeleton," or "nucleus,"

of the molecule, around which the atoms, having few (two or three) bonds engaged, are distributed in a variety of ways. This variation of the "skeleton" and "flesh" of the molecule is the measure of the differentiation among proximate principles. Slow oxidation of moist organic substances, especially those containing nitrogen, gradually consumes without sensible elevation of temperature. This has been called "eremacausis" (or burning by slow degrees). Fermentation and putrefaction are both examples of oxidation also, but with sensible elevation of temperature. Fermentation is distinguished by giving off no offensive gases, and by producing useful compounds; putrefaction is characterized by the exhalation of offensive and deleterious gases. . . .

By this play of affinities, under the direction of the demands of the types of all forms of molecules composing human protoplasm, we have the elaboration of all the proximate principles belonging to the tissues of the human body, embryonal and adult, of a healthy or diseased character. Just how it is that the changes of position of molecules effect difference in the proximate principles,— protagon, neurine, myeline, mucine, olein, margarin, cholestrine, cerebrinlecithin, and a host of others (isolable, real and hypothetical bodies, nevertheless veritable radicals of the deciduous and permanent tissues of the body),— is not just yet demonstrable without great labor with expensive apparatus.

But we do know, and can demonstrate, that tensile strength belongs to fluids as well as solids (if not to gases also). Bubbles on pure water prove the tensile strength of H^2O to be a fact, which is more easily displayed by adding soap, or other viscous substance, to the water, after which bubbles of large size and great strength may be formed, which retain their shape long enough to permit elaborate inspection. Another proof of the tensile force of water may be shown by pouring it from a perforated vessel on a smooth pool, when many spherules will be seen to roll over the face of the placid sheet for some time before melting into its body. It is said that a stratum of air intervenes between the drops and the pool; but what enables each drop to retain its sphericity if it be not the tensile strength of the water?

The rushing of the molecules of protoplasm, under the stress of the inflammatory process, has many degrees of rapidity, hence the variety of the so-called products of this process. It may be

affirmed that the first degree results in *pus* — a simple inoffensive body of dead blood,— fluid and corpuscular; the second degree in *sanies* — an offensive, decomposing mass of dead blood, evolving sulphuretted hydrogen; the third degree in *ichor*—a yet further disintegration of blood, mixed with dissolved and rotten tissues,— soft and hard. All that follows in this disgusting recapitulation (of demoniac possession) is the complete subversion of physiological dominion by chemical control of the elements of flesh and bone. . . .

How do we subdue fire? First, by cutting off the supply of fuel; second, by quenching the flames. How is this last best accomplished? Not by water, unless it be sufficiently abundant to flood the whole body of the combustible on fire; but by enveloping the whole mass in a sheet of carbon-dioxide, or any fluid or vapor having no affinity for oxygen, or into which oxygen does not enter as a constituent. Where the fire is well kindled, in an obscure building or part of a structure, it may be wise to isolate that locality and allow the fire to burn out. Just so in local inflammations in territories that can be cut off, preventing contamination of the whole system, it will be wise to ligate or compress the channels of neural and blood supply, until, by thus establishing physiological rest, the morbific form of metamorphosis is arrested. Afterward normal nutrition may be depended upon to spontaneously take charge of the territory upon the re-entrance of nerve and blood supply.

Paronychia ("run-round"), which is an acute inflammation, has often been aborted by persistently plunging the finger into lye of wood-ashes at the boiling point, dipping it in and out at intervals of a few seconds, until the nerve-currents and blood-currents were so controlled as to discontinue the pain and swelling. Whenever this method is vigorously and persistently pursued, a rapid cure is attained. Even that terribly painful periosteal inflammation called felon may be aborted or cut short by tightly bandaging the finger or thumb. To be sure some pain may follow this method, but it is better to pursue this course, even though no anæsthetic be used to bridge the period, than to let it run its own course to full suppuration. The safest anæsthetic to use in such cases is ice, or ice and salt, to produce numbness of the part, until the retrogressive metamorphosis may be controlled. Evaporating lotions of various

substances are worthy of trial,—one of the best of which is common ether (falsely called sulphuric ether). Rhigolene is also efficient. . . .

Depletion by diaphoresis, catharsis, or phlebotomy, coupled with nauseants pushed to the accomplishment of the purpose (viz: the arrest of inflammation), are methods within the reach of all, and absolutely harmless in the hands of ordinarily intelligent patients and practitioners. Bandaging answers a valuable purpose in our efforts to produce physiological rest of inflamed territories. Strips of sheet rubber, judiciously applied, are excellent means to drive back the excess of blood in the extremities. In cases of bruises, or loss of tone of the capillaries from any privation of nerve-currents inducing sugillation, such as the petechia (or flea-bite) of low forms of fever, the application of a succession of layers of contractile collodion is an admirable means of removing the blood from these extravasated spots, and from the congested capillaries. Eruptions of all sorts that appear as pimples, if left to themselves, may be successfully treated by the use of collodion, applied in the manner indicated, and faithfully renewed whenever it cracks, until the danger to the face, neck, and exposed portions of the skin, is past. All this is applicable to the prevention of pitting in small-pox.

With these principles and remedies and methods of applying them, coupled with a little common sense and entire control of the patient, no one is justified in allowing inflammations to run their natural course, as is the almost universal practice among general and special surgeons.

Let us examine the excretions of the human body while in febrile action, and see if the difference between health and disease does not consist in the more rapid combustion of the nitrogenous tissues. In healthy or normal activity the stored nitrogen remains constant in quantity, the system appropriating precisely as much as is eliminated in a given time. During the continuance of fever the amount excreted is many times as much (from two to seven) as the system appropriates; and this is of course, in part, at the expense of the stored up nitrogen in the blood-corpuscles, muscular tissue and albumen.

In seeking for the cause of this difference of waste, pathologists have been driven to the acceptance of a "contagium," or "materies

morbi," as the immediate agent of disease. In this view the "contagium" is a "lighted torch," whereby the special example of combustion converts the tissues into the resultant products of water, gases and ashes, at the point where the "contagium" or "infection" takes hold of the elements of the tissues. The ashes are composed of salts of soda, potash, lime, iron, etc. Where all these salts are eliminated in due proportion, we have the example of physiological wear; where the potash is eliminated in great quantity and the soda suppressed, fever is manifested in the degree of departure from the normal balance of eliminative currents.

REPORT OF COMMITTEE

ON

DENTAL EDUCATION.

By J. N. CROUSE, Chairman.

TO our colleges must we look for needed reforms in dental education, for they determine the standard of education for the future dentist; therefore, my report will be chiefly devoted to the subject of dental colleges, and, in connection, the much discussed but yet unsettled question of whether dentistry shall be a distinct profession or a specialty of medicine.

In the first place, we believe there should be a concert of action at least on some of the vital points in the management of our schools. If there could be unanimity enough in the different college faculties to form an association and to adopt certain regulations in regard to the schools, we believe the profession at large would support them in any advance movement, or in adopting as high a standard of education as they might see fit.

If they would all require each student, before entering, to have not only a thorough education in the various branches taught in our public schools, but sufficient knowledge of the higher branches to be able to at least comprehend the lectures as they are delivered, this would be one step in advance.

Next, when a student is prepared he should be allowed to enter the college, regardless of how long he has been with a preceptor, instead of requiring that he shall have studied with a preceptor two years; which means, in a majority of instances, that he has done the menial service for some practitioner for two years, and has made but little of that preparation which is necessary to enable him to derive the full benefit of the lectures.

Then, if such a degree of proficiency should be required as would take the average intellect three courses of lectures of eight

months each, the profession at large would endorse such a movement with wonderful unanimity.

Even more; if the college faculties should insist upon all dental students having a good medical education, the profession would say amen to such a step.

Again, the general sentiment of the profession is that there are too many colleges.

I reported, last year, twelve dental colleges in this country, besides several others in an embryonic state, in various stages of development. Since then there have been two births, but so far as I know there are no deaths to report.

The question of how our colleges can be best conducted, whether in connection with medical schools or independent of them, seems to be as far from being practically solved as ever.

Of the two dental schools founded during the year, one, the Western College of Dental Surgeons, is independent; the other is in connection with the University of Pennsylvania.

The Western College of St. Louis, as per announcement of its founders, was gotten up for the purpose of taking a step forward in the cause of dental education.

The announcement says that it is founded on the principle that no one knows as well as the practicing dentist the kind of instruction a dental pupil needs at the outset of his career. Therefore, its instructors are gentlemen in daily practice of dentistry as an occupation. It says, further, that the incorporators believe the true way to promote the cause of dental education is to raise the standard of requirements of dental graduation. It also says that they believe in allowing any one who is qualified to pass the examinations, to receive a degree without attending the lectures.

These are the main points, in brief, upon which this new school is founded. Like most of the colleges that have been started from time to time, this one proposes to make advancements in dental education.

The first, and what appears to be the chief, difference in this organization and the one on which the improvement is based, is the "principle" that no one knows as well as the practicing dentist the kind of instruction the dental pupil needs at the outset of his career; and on this account the faculty is made up entirely of practicing dentists.

It is difficult to see how this change is to make much of an advance in dental education; for in the first place several of our schools are already following this plan with the exception of the chair on Anatomy and Therapeutics, and, in some, Chemistry and Physiology,— all of which branches can be best taught by the one who knows the most about the subject and has the best faculty of imparting knowledge, regardless of occupation. There can be no objection to his being a dentist if he possesses the knowledge and the ability to teach what he knows. But if I have a correct idea about it, the practicing dentist, educated in a dental school alone, will know much less about Anatomy, Physiology, Pathology and Surgery, Therapeutics, or any of the subjects in medicine, other things being equal, than the medical man who has received his education in one of our best medical schools. One reason for such being the case is that, as a general thing, while preparing for college, the dental student spends a large share of the time working in his preceptor's laboratory, learning the mechanical part of dentistry, while the medical student is reading his books. The same is true after enter entering college. From four to five hours each day are spent by the dental student in the clinics and laboratory, learning the details of practice, which time is spent by the medical student in attending lectures or reading his books. So that if the instruction be equally good on the subject named, in the dental school, the medical student has given them more time and study, hence has a better knowledge of them. So that the claim of superiority on account of the faculty being made up entirely of practicing dentists will not stand the test, the facts being that they are not generally as well informed as medical men on subjects connected with medicine, which are taught in dental colleges, for the reasons already stated.

In fact, if my arguments are correct, the faculty made up entirely of practicing dentists, on general principles, must be inferior to a mixed faculty of both medical and dental practitioners.

The only other part of the policy of the Western College which we propose discussing here is that of granting diplomas without an attendance upon lectures.

It would seem but right to grant a diploma to such men as are fully qualified to practice, without requiring them to attend lectures to secure one. Indeed, it would advance the interests of the

profession rapidly if all who were fully qualified were granted diplomas, and then such legislation secured as would prevent those who could not pass the examinations from prefixing "Dr." to their names.

The granting of diplomas without an attendance upon lectures should only be done where the candidate is fully qualified, and, it would seem to us, only by such a board or faculty as are of well known ability, and have the entire confidence of the profession.

It would seem as if the faculty of this new college is made up of two few men who are thoroughly known in the profession to take upon themselves the responsibility of granting diplomas without an attendance upon lectures.

In fact it would be better that the power be outside of any one of our college faculties. A board made up out of an association of all the respectable college faculties would be much more likely to yield satisfactory results. At least it should be such, and only such, a board as would meet the approval of the profession.

Just here it may not be out of place to incidentally ask whether state societies or examining boards should grant diplomas to those who pass the examinations required of them by a legislative law, such as has been secured in some states. If any other state except New York does this it is not known to the writer. It grants the degree of M.D.S., which title we see used very freely at times by the holders. It would seem better to grant a simple certificate of having complied with the law, thus doing away with both diplomas and titles which are used sometimes improperly.

The other new college to which we referred, in connection with the University of Pennsylvania, is on a different plan from the Western, being in connection with a medical school, although not unlike in this respect several of our dental colleges.

This school starts out with very complete equipments for clinical purposes, lecture rooms, etc., and the teachers are well known as men of ability. A majority of the chairs are filled from the medical department of the University, two of the faculty only being practicing dentists.

The addition of a dental department to such an institution as the University of Pennsylvania would seem to be an addition to our dental schools which should be a cause of congratulation. There are some features of it, however, which may prevent it from

taking the advance step which the dental professors in it anticipate. In the first place, it is hard to get medical men to realize that dentists should have a medical education, and if the size of the class govern their compensation for teaching, it is quite natural that they should not insist upon so thorough preparation, if such requirements should tend to diminish the size of the classes.

I do not wish to suggest that this move on the part of the University of Pennsylvania is a money-making scheme, but it is reasonable to suppose, on general principles, that the cause of dental education is but secondary to those outside of the dental profession, and it is likely to be so in the case of this University unless the dentists connected with it have sufficient interest with the powers that be to make what I believe they desire—an advance in dental education. The same holds good in all similar institutions.

For, if I have a correct idea of human nature, we need not expect, so long as we insist upon being an independent profession, that those outside of our ranks are going to take a very great amount of interest in how much education we have, except as they are influenced individually. Even with the medical profession, although there is an acknowledged relationship between us, it is too distant, as at present held to be, to get their full sympathy.

We see a decided disposition on the part of some of the regular schools of medicine to add a dental college, which, of itself, is quite gratifying, as showing, at least, their appreciation of our strength. Some good may grow out of this in bringing the dental students closer to the medical schools, which will have a tendency to cause some part of them to take a full medical course. At least it gives them good medical instructions in as far as the dental course requires them to study medicine.

There is, however, a danger to be apprehended from this disposition on the part of medical schools. It is the increasing of the number of dental schools; forcing, as it were, an increase without the profession at large, or the dentists in the immediate vicinity, being able to prevent it.

It would seem to me that the degrees conferred by the dental colleges in this country should be uniform, and, as the title of D.D.S. is the oldest, and has been adopted by all the colleges save one, that *this* should be universally adopted unless some other can be found that will express more appropriately the nature of

our calling. Certainly the degree of Doctor of Dental Medicine has no advantage in this respect over that of Doctor of Dental Surgery.

The matter of clinics is receiving special attention in many of our colleges. Besides increasing the conveniences, a large number of clinical instructors are being appointed in addition to the regular faculty, who give stated clinics to the students of the various classes.

This policy is being pursued by the schools in Philadelphia, New York and Cincinnati, and perhaps others that I am not aware of. This addition to the usual teachings in the practical part of dentistry can but result in good to the student, and it would seem as if all the schools could adopt this plan of teaching with advantage to their classes.

The Pennsylvania College of Dental Surgeons has gone into much enlarged quarters, has added anatomical rooms, and requires that each student shall dissect during one session of his course. It and the Philadelphia dental college have also arranged with the Jefferson medical college, whereby graduates of their schools can become candidates for graduation in that institution by attending one course of lectures.

The same is true of the dental department of the Universities of Pennsylvania and Michigan with their medical schools. About the same arrangement is made by the New York school with one of the leading medical schools of that city. I believe that similar plans have been adopted by some of the other schools.

Quite a number have also increased the length of term of lectures; in addition to the spring and summer courses, requiring five, instead of four, months in the regular or winter course. The Harvard school has increased its course to eight months, and requires attendance during the two full terms.

These various changes show a desire and a determination on the part of some, at least, of our dental colleges to make advancement. But the change which must come sooner or later,—and from various indications it would seem must soon come,—is but a change from the partial to the complete, and in this evolution dentistry steps into its place as a branch of the science of medicine.

To be more explicit, let us urge that the dental student first be medically educated, then dentistry follows as a specialty of

this liberal education, just as does ophthalmology, dermatology, obstetrics, gynecology, etc.

If those universities and medical colleges which have attached to them dental instructors had adopted this plan, they would certainly have received sympathy and support from a majority of the intelligent members of the profession, but thus far they have only opened more dental colleges, giving a partial degree representing partial instruction, and the opportunities they offer do not excel those afforded by our best dental schools.

It cannot be denied that the teeth are an important part of the human economy, and that unfavorable systemic conditions are as positively and certainly impressed upon these organs as upon any others.

Improper nutrition from any cause is so unmistakable in its results, that the dentist, to fulfill his mission in the highest acceptation of the term, should be not partially but thoroughly educated in medicine.

The natural inquiry arises, would you require the dental student to spend more time in his preparation for practice than is demanded of the medical? We answer, not more than is exacted from the specialist in medicine, who, after acquiring his degree of M.D., has but just commenced the preparation for his life-work. Preceptors, infirmaries, clinics, both at home and abroad, are sought that he may more thoroughly learn the relative importance of the parts he has chosen to treat, their intimate relation to the animal economy, etc.

The practice of medicine is daily becoming more and more divided into branches, which we term specialties, and students who expect to practice any one of these obtain the degree of M.D. only as a preliminary step toward the acquirement of that special knowledge which is requisite to perfect them in such branch of medicine as they may have elected to practice. Now, this course leads to what we call a *higher* education, and those who adopt it acquire the greatest success as practitioners. To what extent we, as an association, can foster this plan, or force the dental student to adopt it, is open for our consideration. But while working to secure this — our most complete conception — we must remember that advancements in education, like those of individuals and societies, are rather of spontaneous than artificial growth.

REPORT ON DENTAL EDUCATION.

By THOMAS FILLEBROWN, of the Committee.

ONE year ago this Association passed by a decisive vote a resolution declaring a thorough medical education essential to the most successful practice of dentistry. A resolution declaring it expedient and practical for medical schools to add dental instruction to their curriculum, and thus afford opportunities for dental qualifications for students as well as in other branches of medicine, was not passed. The reason of this, I feel, was largely due to a misapprehension, through lack of a full discussion of the matter; and for this reason I call your attention to this point again, asking your thoughtful attention to the subject and its careful consideration, and also such action upon the question as shall, in your judgment, best promote the interests of educated dentistry.

As germane to the question, and necessary to the full understanding of the further discussion of it, I reproduce a synopsis of the points made in my former report.

In that report it was assumed that dentistry is a specialty of medicine, because it is so written in the preamble of this Association. That a medical education is but the foundation which prepares its recipient to perfect himself in whatever specialty he may choose to practice.

Though an ophthalmic or aural surgeon, or a dermatologist or other specialist, may do much good without it, yet he needs a thorough medical education, and all would regret a state of public opinion that would tolerate such practitioners.

Surgery of the eye and teeth are as intimately associated with each other as are their anatomical relations.

Inflammation of the dental branch of the fifth pair of nerves differs not from that of the ophthalmic branch. Nor are ulceration of the mucous membrane of the mouth and eye dissimilar, and the treatment of these and other cases is governed by the same general principles.

It is conceded that, other things being equal, the medically-educated man is best fitted to practice dentistry. When a med-

ical graduate attends a course of lectures in a dental school, a noticeable respect is paid to his superior acquirements, and he will almost pass without examination. The greater includes the less, and the medical graduate has only the handiwork and technicalities of dentistry to learn. As a rule, those who have done most to elevate and improve dentistry have been medically-educated men. Our literature is the product of the same class.

Of sixty-eight standard works fifty-two were written by graduates in medicine, and those of the most scientific value.

Dental science is a part of a whole. It is impossible to fully understand a part without understanding the whole.

The operator who treats abscess, ranula, or necrosis, needs medical knowledge as much as he who cuts for cataract or enucleates the eye.

The effects of pregnancy and lactation upon the teeth are such as to refute the idea that a knowledge of this subject is superfluous.

The subject of anæsthetics also demands a thorough understanding of the best means to control their influence.

While the fact still remains that dentistry consists very largely of essentially mechanical operations upon the teeth, so far from this being a reason for less preparation, it is the strongest argument for the more thorough and extended preparation.

Specialties tend strongly to run in a groove; hence the more need of the antidote.

The expediency and wisdom of medical schools including dentistry in their courses of instruction appear for the following reasons: More schools are needed, and more widely distributed, so that more inducements and facilities may be offered to young men to obtain a good education, instead of less, as has been advocated.

Where a professional school is located, there will exist a higher standard of professional excellence.. Where a dental school is established, there will be superior operators and superior patients.

The establishment of new schools has not injured those previously existing, nor would any such suffer by opening the doors of medical colleges to dental students.

The faculties of dental schools are deserving of all honor; they have advanced as fast and as far as the profession would support

them, and their hands should be upheld. The proposition to include dental subjects in a medical course implies no reflection on them. Their advance has been in including more of general medicine in their courses of instruction, and in that direction it still must lie until they, too, will cover the whole ground, and to this they are sure to come.

The ideal dentist will first graduate in medicine, and then take a post-graduate course in dentistry. Few, however, will do this, and while taking a medical course there will be ample time for becoming familiar with the specialty of dentistry. The few mechanical principles governing the filling of teeth, and the making and adjusting of artificial dentures, are readily understood; and not many months are necessary to acquire sufficient skill in their application with which to commence practice. With the general medical principles involved, it is different — those can only be acquired by prolonged study, extending over several years. And no amount of simply dental knowledge will give a man more than a partial culture.

In case a student makes a mistake in entering the practice of dentistry, being not well fitted by natural abilities for it, if medically educated he may correct his error by seeking some other branch of practice; and the contrary is also true, and many a poor doctor, with superior surgical talent but no opportunity to use it, might become a brilliant dentist.

The favorable action of the Cumberland County (Maine) Medical Society, the Maine State Medical Society, and the Portland School of Medical Instruction, were quoted to show the sympathy the medical profession feel toward dentistry as a specialty of medicine, and their desire to meet any approaches more than half way.

In the discussion on dental education last year, it was quite evident the plan by which dental instruction was to be given in medical schools was not clearly conceived, and, of course, not well understood nor sufficiently discussed to produce any common understanding of the question or unanimity of opinion among those who are already in favor of the movement.

In order that we may make some progress toward a definite opinion on the question, I present it at this time.

Dentistry, as a specialty of medicine, is, perhaps, more distinctly a branch of surgery, but in either case distinctly medical, and

deserves full recognition as such by dentists as well as by the more general practitioner, and should be included in the course of study of every person who presumes to have a good medical education. Indeed, no one can presume to be completely educated in medicine unless his studies have extended well over so important a branch as dentistry.

It is not well for any student to give principal attention in the beginning to the simple practical part of any subject, if he wishes to become master of it; he must first attend to the principles upon which it is based, and let the practice follow.

Such is the custom and policy of every profession — practitioners of dentistry not excepted. With these it has been the main idea to become sufficiently skilled to make a set of teeth, and to make a passable filling, and be able to wrench out a decayed stump with a degree of skill that shall save from a conviction for malpractice; then seeking only as much of the knowledge of the principles which underlie all practice as they may feel obliged to do to secure a diploma.

I am glad to feel assured that the present is not colored quite so darkly as this, but still I feel that the blot is not all washed away.

Thirty-two teeth, however well understood, are not enough to establish a distinctive and liberally-educated profession upon, and just in the degree that we confine our studies to this point alone shall we fail of becoming liberally-educated men, and just in degree that the education of dentists embraces the principles of a general medical knowledge will they be able to lay claim to be men of wide culture in their chosen line of practice.

"First a generalist, then a specialist," is a proverb we cannot too often hear nor too fully heed.

It has been assumed by many that if dentistry is taught in medical schools, it will be taught by instructors not practising dentistry. Objection to the plan must have been father to the thought, for nothing can be farther from the reasonableness of the thing, nor farther from the practice long well established in medical schools of this country, excluding occasional exceptions in case of anatomy and chemistry. The invariable rule is that professors and lecturers in every school are men in active practice in their several branches, and lecturers on special subjects are selected in every

case because of their activity and success in the practice of their specialty. No different rule could apply to dental instructors. Any school that wished to teach dentistry would and must select those men for instructors who know the most about it, and none can know except they be in active practice.

This seems a proposition so evident as to need no argument, and no other idea can be entertained upon which to base any proposition looking to a consummation of such an arrangement.

A crystallization and expression of opinion upon this question becomes the more desirable and important at this time in the light of the fact that so many new schools are being established, and that old, honored and cultured universities are taking upon themselves the perpetuation of a partial degree, thus binding the bands about us the more firmly. Harvard University, in doing such a thing ten years ago, was taking a long stride in advance of the opinion of the day, and going adverse to many prophecies of failure.

The University of Pennsylvania, doing the same to-day, is but trailing a long way behind the well-pronounced judgment of a very large portion of the better qualified practitioners and thinkers of the present time.

The argument that the more advanced action would not be sustained is, I believe, not true; and if true, not applicable to a case like this. Such a time-honored and wealth-honored institution ought to take and maintain the most advanced position in any department it may adopt, and cannot afford to do less.

I can only add a word of regret that dental education should have thus received a check from this source; but it only retards a little; the movement will go on until full success is reached.

What would not be said in condemnation of the action of any university in the land that should establish a partial course for ophthalmic surgery or dermatology, or any other specialty save dentistry, and confer a degree for the same! Public and professional opinion would not allow it. Now, what can be said of this one exception of dentistry, save that, like the sin Pope writes of, public opinion has learned to endure, pity and embrace?

Michigan and California universities of course share with the others in my regrets. They might, all of them, to-day be giving dental instruction by the same able and worthy teachers, and giving their dental graduates the well-rounded instruction and title of M.D., practicing their specialty of dentistry.

Another thing that keeps the dental degree second to others is that, in many of our schools, branches that are pursued in common with a medical course are passed less thoroughly upon in examination than is expected of medical students.

So long as this state of affairs exists, dental students will be second rate in their scientific acquirements. There will be individual exceptions, but the rule will hold good.

The considerable number of students that take first a medical course, and then a dental course afterward, shows that there is quite a demand already for a medical education for dentists. And it is none too soon for the opportunities to be offered those who are willing and desire to take the broader instruction; and as a matter of justice to them, they should be afforded these facilities in their medical course.

The way seems to me very plain and very easy. If Harvard, Michigan and Pennsylvania universities had made just the same preparations for clinics and for infirmary practice, and had appointed the same worthy and able men as instructors, and then said to the public and to their students, "Dentistry is medicine: any one who wishes to study dentistry can come here and enter the medical department of these institutions, and study it the same as any other branch of medicine is studied, and graduate under the same rules, pass the same examinations, and receive the same degree, and possess the same culture and ability, as far as they are obtained here,"—this would have been the perfect solution of the problem, and in my judgment, the result would have proved to be signal success.

Had this been done, or should to-day any number of other medical schools take such a step, there would be no antagonism between them and existing schools — these are already established, and would not suffer in any way; it would only make it the easier for them to do what they all so much desire, i.e., to raise higher the standard of dental education.

D.D.'s, D.M.D.'s and M.D.'s agree perfectly well in this Association, and they would if the M.D.'s were doubled in number.

This Association considers the degree of M.D. a sufficient credential of scientific fitness for admittance to membership in this body. It believes dentistry to be a specialty of medicine. It believes a well rounded medical education essential to the most successful practice of it.

I wish I might add a belief in the legitimate sequel,—the advisability of medical schools offering to their students instruction in this most important branch of medicine.

If objection is still raised that such a course will not afford time for acquiring skill in dental practice, I will again refer to the fact that so large a portion of dentists practicing to-day entered upon their professional life with much less dental preparation than this would afford, and their success has justified their course.

Less schools and better, I repeat, will not avail; making less will not make better, but the opposite. Competition is the life of schools as well as of commerce. The efficiency of our dental schools has increased in a steady ratio with the increase of their number. The number will inevitably further increase — no power will prevent it — and the duty of this body is to so exert its influence that it shall aid in increasing the thoroughness and breadth of the instruction there to be given.

Let us not be anxious about the recognition physicians, or any one else, may extend to us as dentists, but let our anxiety be that we ourselves, as well as physicians, properly recognize the importance of dentistry as a medical science and medical practice.

And when physicians know as much about dentistry as they should know, and when dentists know as much about medicine as they should know, all question about recognition or mutual respect will cease to be raised, and there will be no more "sickly sentimentality about claiming fellowship with a profession that disclaims us"; for all will be of one family, owning the same Alma Mater, and laboring for the same common good — the amelioration of human suffering and the elevation of the human race.

Such a plan was proposed by Dr. Gardette, of Philadelphia, so long ago as the time when the Baltimore Dental College was chartered. How vastly better for the practice of dentistry had his influence prevailed and his plan been adopted.

That this Association may record its action in favor of a "consummation so devoutly to be wished," I offer the following:

WHEREAS, Dentistry is a specialty of medicine, and requires, as do other specialties, a thorough medical education as preliminary to its most successful study and practice;

Resolved, That we deem it expedient, and for the best interests of the practice of dentistry, that existing medical schools so enlarge their curriculum as to include efficient instruction in dentistry, and thus make the requirements for graduation the same for this as for other specialties of medicine.

REPORT ON DENTAL EDUCATION.

By GEO. J. FRIEDRICHS, of the Committee.

IT is with considerable hesitancy that I present this paper on Dental Education, being well aware that there are many in this association who could have done the subject more justice. But as you have seen fit to appoint me as one of the committee, with the implied expectation of hearing from me on this subject, I will, to the best of my ability, try to give you my views and opinions.

The day of private tuition has gone by; the public and the profession demand a collegiate education in dentistry.

The sense of this association, at its last annual meeting held in Chicago, was thus expressed:

"Whereas, Dentistry is a specialty of the science of medicine;

"*Resolved*, That we esteem a sound and thorough medical education essential for the most successful practice of it."

From the above dictum it would follow that, in order to be or become a successful dentist, one must first obtain a degree in medicine. Now, although the holder of a medical diploma *atque jura*, is presumably qualified for the practice of all specialties — since a diploma in medicine is supposed to cover the whole ground,— yet, as the science and art of dentistry are not included in the curriculum of a medical course, it naturally follows that the scion of medicine who wishes to devote his acquired knowledge to the treatment of the oral cavity and the preservation of the teeth, must receive the necessary instruction for this from some other source than the medical school.

What has the student learned about dentistry in the course of his medical studies? He has hardly learned how to extract teeth, let alone the higher art of preserving them. He may have acquired a knowledge of the anatomy of the mouth; but aside from this, would be no more competent to practice the art of dentistry than a first-class tinsmith would be to construct an artificial denture.

The medical profession, for some unaccountable reason, has been averse to recognizing specialties. Yet in the science of

medicine there is one specialty that has been recognized as appertaining to it,—that of ophthalmology. Therefore a regular graduate in medicine ought to be an ophthalmic surgeon. But such is not practically the case; otherwise graduates in medicine would not give their time and money to become pupils of celebrated oculists, such as Von Gräfe, of Berlin, and other celebrities in this specialty, in order to complete their studies, and thus make themselves competent practitioners.

The same reasoning holds good in regard to our specialty: a doctor of medicine would either have to enter for another course in one of our dental colleges, or get his instruction through a private source from some competent dentist.

Now as to specialism. Dr. Beard observes, "that success, even with the most richly endowed natures, is only possible through specialism. It is peculiar, as some would believe, to modern science or recent civilization, yet all the famous Greeks were specialists. In the present century science has become so specialized that all the advances are made by specialists in comparatively restricted fields. In spite of all criticisms, the work of specialization has gone on, and, in obedience to the law of evolution, must yet go on. Those who have confined their study to particular branches are our best authorities. Science and specialism are identical; not to specialize is to lose the prizes of life. Germany, which in philosophy and science does the original thinking of the world, is, as we all know, a nation of specialists."

Dentistry being a specialty, must be taught by specialists, in the art, who are in actual practice; but a medical course ought to precede such instruction.

This is the position that has been already assumed by this association, and to me it seems a healthy sign, giving promise of a higher standard of education for the coming dental surgeon.

In considering this subject, we must bear in mind that there are two objects to be kept in view; one is the education of the mind, the other the education of the eyes and the hands. To the former belongs the theory, to the latter the practical application. Of these two, the practical education is the more important, for without it a successful practice in dental surgery is out of the question.

In tracing back the history of dental surgery in this country, we find that "Dentistry was introduced into the United States by

Le Mair, of the French forces which joined our army during the revolutionary war." The first American dentist was Dr. John Greenwood, of New York, 1788. In 1820 the profession numbered a little over a hundred; in 1832 about three hundred; twelve years after, fourteen hundred, and at the present moment is estimated at about ten thousand.

In view of this rapid growth, and of the fact that medical schools did not teach dentistry, and inasmuch as private tuition was found to be insufficient, and the necessity for instruction in our specialty was growing imperative, our predecessors followed the only course which seemed likely to meet the exigency, and organized institutions for teaching dentistry exclusively.

The initiation of our dental colleges was an advance toward a higher standard in the profession, and the dentists of to-day owe a debt of gratitude to the organizers and teachers in our dental schools for their labor of love in this field; for it is well known that they have not been adequately remunerated for their services given in this cause for the past thirty years, and through which the profession, as well as mankind in general, have been benefited.

Yet I think there is still room for improvement in the practical teaching in the infirmaries connected with our colleges. In looking over the annual announcement of the Pennsylvania College of Dental Surgery, session of 1876–77, an institution which I believe will compare favorably with any similar institution in this country, I find, by their own admission, that the number of fillings inserted per student for the past five years only averages thirty-six. In the session of 1875–76, if we leave out such materials as require hardly any skill in their manipulation, and confine ourselves to gold and tin, we find the average per student twenty-nine and one-seventeenth. As this school requires the student to attend two courses of lectures before he can graduate, and admitting that he would perform an equal amount of fillings during each session, we have the total amount of operations fifty-eight and two-seventeenths for each graduate.

Now, I will leave it for you, who represent the high standard that dentistry has attained in this country, to say whether a graduate from our dental colleges under these circumstances is competent to practice the art of dentistry.

I may be met with the assertion that *some* would be competent.

True; so we have had most learned and eminent men who never received a collegiate education; but their number has been, "like angels' visits, few and far between."

The most important operation in dentistry is that of filling. Any one who sets himself up to perform this operation, and who is not competent, is, in my estimation, worse than a thief. A thief steals only filthy lucre, while a dentist incompetent to fill a tooth properly adds abuse to injury, for he not only inflicts unnecessary pain, but steals his patient's time and money. He gives the assurance that the tooth operated upon is put in a condition for future preservation, while before a competent operator is consulted caries may have progressed to such an extent that the vitality of the tooth is endangered, and an irreparable loss to the patient may ensue.

Recent graduates in medicine are not supposed to be as competent as practitioners of years of experience, and all that is expected of them is, that they have acquired the general principles upon which is based the science of medicine. A course in medicine is only the initiatory step upon which the graduate is to build in the future by continued observation and study, as the field in the science of medicine is so large that no human mind can grasp the whole of it, and become competent in all its branches.

Therefore I am willing to concede, when a medical faculty affixes its signatures to a diploma, we must allow it more latitude than we can that of dentistry. The latter being a specialty can be acquired more thoroughly, and I question the right of a dental faculty that licenses and authorizes incompetent parties to practice the art of dentistry.

In view of these facts, I would recommend that the president of this association be authorized to appoint a committee of one at every place where a dental college is located, to report to this association the advantages possessed by each for the practical teaching of the science and art of dentistry. As practical anatomy cannot be learned without material for dissection, neither can you learn how to fill teeth unless you can have patients that require teeth to be filled. This association being represented by delegates from all parts of this country, having the standing and welfare of the profession in view, belonging to no dental college or clique, has the right to investigate this matter, and to recommend such insti-

tutions as possess and offer the greatest advantages to students who may wish to acquire a thorough dental education.

For who are to define the requisite qualifications of a dental education, and who are to say who shall be the educators, if not this association? Certainly not those outside of the profession. In the words of Prof. McQuillen: "As the profession has been elevated from its primitive condition through the successive labors of innumerable minds, it is alone by the continuation of such efforts, on the part of those who succeed them, that the point reached can be maintained, and additional advancement secured." Consequently the blame, if any, lies with us if students do not in the future obtain a thorough professional education before receiving a diploma or a license to practice dentistry.

DISCUSSION.

Dr. R. Finley Hunt: The general objection to the proposition contained in the resolution of Dr. Fillebrown is that we are putting dental education beyond our control. We have brought it up to its present standard as being members of the dental profession, and not members of the medical profession. We have done this without the aid of the medical profession, by our own exertions. We are anxious to promote the cause of dental education, and to elevate the standard; but if we place this matter in the hands of the medical profession entirely, by throwing our means of education into their schools, we shall thereby put the matter outside of our control, and in the hands of others who have taken no part in the work we have been doing. With reference to the education in a dental college, we admit the justice of the position taken in the papers read, and I refer especially to that of Dr. Fillebrown, that a medical education is necessary to the proper practice of the dental profession. The paper proceeds upon the supposition that the dental colleges do not give a medical education. That is in fact a mistake. Every dental college has a faculty, and the professors teach every subject,— physiology, anatomy, pathology, etc.,— that is taught in medical colleges. Then the question arises, not on the means that we have, but the efficient, conscientious use of those means. The expression was made use of in Dr. Fillebrown's paper, of "simple dental educa-

tion." If he means by that simply the operation of filling teeth, I will grant that he is right; but I contend that the education taught in a well-conducted dental college is not what he means, I presume, by "simple dental education." A dental education properly taught in a well-conducted dental college includes a thorough knowledge of medicine in its generalities. Whether we are a distinct profession I do not think enters into the discussion of this subject; we are all aiming at the same object,— that is, the thorough and proper dental education of those who enter into the profession. The only difference that arises is as to the means we would use to attain that end. I think if we could have more thorough unanimity of action, and more thorough consultation as to the use of the means at our disposal, we should arrive at more satisfactory conclusions regarding the best method of securing a proper dental education. I therefore give notice that when this discussion is closed, I shall move to refer this preamble and resolution to the section on dental education, so that we can mature it properly, and have the results of combined consultation of all the members of our association who take an interest in, and who have given thought and study to, the subject of dental education.

Dr. Ingersoll: As I understand the resolution and the reports, the proposition is to give the same degree to the man who proposes to practice general medicine and the one who proposes to practice dentistry. Is it understood that a medical man shall be required to be an educated dentist?

Dr. Fillebrown: In theory he must be, just as fully as the man who is to practice dentistry.

Dr. Ingersoll: I remember in reading over the constitution of the first dental society organized in this country, there was used this language with reference to the object of the organization, "to make the dental profession respectable." It has ever since been the effort of dentists to raise themselves in the respect of the community, and in their relations to the professions generally. It has been observed by men in other professions that the tendency has been downward rather than upward. This is true, no doubt, in theology, law and medicine. In the present effort of the dental profession to elevate the standard, it seems to me we are beginning in the middle of the ascending scale rather than at the beginning. We have not so much need of full medical education as of ele-

mentary and general education. I could not be satisfied with any man pursuing simply a medical course as a qualification for him to enter upon his dental course. It seems to me we are making too much of this and too little of the preliminary qualifications. I have had some knowledge of the methods by which young men qualify themselves for the practice of medicine. A young man who has for two or three years attended a doctor's horse, and imagines that a doctor has an easy life, says, "I believe I will be a doctor"; and he goes to a medical school, with not even a common-school education, enters that medical college, and graduates as an M.D. I have known large numbers of medical graduates, and I know large numbers of them to-day in practice, having what is considered a successful practice, who could not write three lines of English correctly. These men did not begin at the proper starting-point. The estimate which this society puts upon a medical education, as a means of making the dental profession more respectable, is too prominent. We must go back to the old proverb, "'Tis *mind* that makes the man."

Unless the college faculty shall insist that their students shall have some preliminary literary training and mental culture, how can they be expected to understand the meaning of scientific terms? All thought is wrapped up in language, and language is the only medium of communication. If students of dentistry cannot comprehend the meaning of terms—which education alone can enable them to do,—how are they to comprehend the language of the books they study pertaining to this important specialty? Unless their minds are trained to systematic thought, how shall they comprehend the subjects which they are called upon to investigate? Therefore I would say, there must be a *beginning* at the *beginning*, before the dental or the medical, or any of the professions will be improved and elevated to a high professional standing, and obtain the respect of educated people. When I entered the dental profession, my friends were sorry to have me do so, because of the low professional standing of dentists of that day, and I was for awhile ashamed of some of the company I felt obliged to keep. I feel so no longer. To-day I must bow humbly before this body of men. You will allow me to repeat that we must elevate the dental profession by beginning at the beginning—at the very substructure of all education, before we can talk confidently of the superstructure of a medical education.

Dr. TAYLOR: Hearing the remarks which have just been made, I could not but wish that Dr. C. A. Harris were present, that he might see the interest which is taken in dental education. It throws me back to the time when we had no dental colleges, and when there was not a medical school in the land that would receive us. At that time our medical schools said they could not enlarge their curriculum of study; they had already too much. If the gentleman who introduced this resolution will go a little further and say to those colleges, extend your studies to three years, and give us a thorough medical education,— I will go heart and hand with him. It is just what we want. I should be glad to see every medical man in this land able to appreciate the science of dentistry, and to comprehend dental disease. We do not find this the case. Are we in the right mind to remedy this defect? I claim that we are. We have brought our profession up to the standpoint where the medical profession are ready to embrace us. What do we care for recognition? We only want to be recognized as a thorough-going profession, able and willing at all times to assume the duties and responsibilities which rest upon us. I recollect so well, in my early life, our friend Dr. Harris and myself were practicing dentistry in neighboring towns. Both having previously practiced medicine, we came to the conclusion, after following dentistry one or two years, that if we continued in this specialty we must have dental colleges. There are but few of you who can appreciate the condition of things then, or have any conception of what dentistry then was. I look around and see the advantages which our young men have now, and feel that we are in a different atmosphere. And yet it appears to me as if the profession were not satisfied with our dental colleges. When our dental schools were first organized, we had a chair of anatomy, of pathology, of practical dentistry and of mechanical dentistry. We have now introduced almost every department of medical science they teach in the medical schools, and I need not be told that our graduates cannot stand a thorough examination in anatomy, physiology and chemistry, for they can, and they do, do it. I have not been in connection with a dental college for years, and yet I know from practical observation and from the assertions of gentlemen engaged in the teaching of medicine, that this is the fact. A few years ago you could not have had such a discussion as we have had in the last two days, in any den-

tal association in the land. All I think it is necessary now to do is to go on in the work. I think the dental institutions should extend their curriculum of study every year in proportion to the demands of the profession. If you who are engaged in practice demand that our course of study shall be enlarged, it will be done.

Dr. FLAGG: Joshua Billings, a man universally known and highly esteemed, has said that "Sensible people are those that think as we do." From that standpoint I view the last speaker as an eminently sensible man. I have had my say on this subject. I merely wish to state that the medical colleges have taken this matter out of our hands, and we can see now how the various departments in medical schools will work; we also will see how our colleges will work, and therefore, without any other demonstration on our part, let us go on and work too, and let us wait, for the present.

Dr. JOHN ALLEN: When my good friend Dr. Taylor was speaking, my mind, too, was carried back to the time when we had no dental colleges, no dental journals, no associations, no means of interchange of useful information between each other as we have now, and it does me great good to see our younger men coming forward and dwelling upon these important and intricate points that were not touched upon in those earlier days. It shows that our march is onward and upward. I like the idea very much as dwelt upon by our speakers, that we need a thorough education in these collateral branches. I contend that a thorough medical education is the foundation for a dental education, but a medical education alone will not qualify a man for dental practice. And it is also necessary for medical men to know more of the principles of dentistry, for the welfare of their patients. For instance, not long since a gentleman in New York became severely afflicted with his eyes. He called upon an eminent physician, who could not account for it. After repeatedly examining his case, the patient growing worse all the time, the physician said he would give a thousand dollars to know what was the matter with his eyes. Finally the gentleman called upon a dentist with whom he was acquainted, who, upon examination, found that it was the cutting of a wisdom tooth which produced the trouble, and upon the tooth being extracted the difficulty was removed. This is only one case. If you will look at the matter carefully you will see there are many cases in which the dentist, unless he has a thorough

medical basis to rest upon, will also be likely to fail to diagnose clearly what the difficulty is with his patient. The same is true with our medical men. They will frequently fail in their diagnosis for want of more knowledge in dentistry, as in the case just cited. Therefore these fundamental principles should be understood as thoroughly by the dental as by the medical profession.

Dr. WETHERBEE: I desire to add my testimony in favor of dental education. I have always been a firm believer in, and an advocate of, education. The greatest curse of the profession is, that there are many in practice who are not properly educated in the science and art of dentistry. They may have done, and are still doing, the best they can with the means and facilities at their control. Nevertheless, there has been a very commendable advancement, and after about forty years of efficient labor on the part of the colleges of dentistry, it has singularly happened that, according to the estimate of some men who have graduated on one course of dental lectures only, but are not liberally educated, and are not graduates in medicine, that they wish, apparently, notwithstanding all that has been accomplished by the *chief factors*,— the dental colleges,— within the forty years past, *to put the profession out to nurse.*

It has been said here to-day, and the resolution under discussion is in agreement therewith, that no man can scientifically, skillfully and efficiently practice dentistry unless he has a medical education. I pronounce this false! That is plain enough, every one can appreciate it. Do not dental colleges embrace in their curriculum anatomy, physiology, principles and practice of surgery, pathology, therapeutics and chemistry? So far as these several branches are concerned, are they not efficiently and successfully taught in dental colleges? If so, then why utter and fulminate this odious slander against and upon dental colleges, which have been, and still are, effective instrumentalities of professional advancement, thereby bringing them into disrepute?

If it is necessary for one to attend a medical college, is it not necessary for all? Perhaps you may say there are exceptions; some men are endowed with large intuition — are great geniuses; I will not except them. Parenthetically, if we are to have a profession characterized by the highest type, possessing the qualifications needful to command universal respect, would it not be well

to first have a liberal education, and, to insure general acceptance in all communities, study belle-lettres, theology, law, etc., that in all associations we may discuss topics and subjects intelligently with those who are accredited scientists? In addition to specified previous qualifications, I would have them graduate in medicine,—and know it, too,—although the practice of medicine is empirical. Having complied with the provisions and conditions anticipated in the resolution, the student's attention should now be given to three years' study of dentistry, with at least two courses of lectures.

If we study medicine for many years we shall be far removed from that which concerns the practice of dentistry. The student who leaves a medical college, with no special training, *is no more a dentist* than I was three days after I was born. In a word, there are no objections to thorough medical training, provided its prestige is not substituted for a thorough knowledge of dentistry.

Dr. DARBY: The views which have been presented by different members of the association are greatly at variance. Some have recommended that there be more dental schools; others that there be less. We might discuss this question for hours and years and not arrive at any agreement. But there is one point which I wish to speak about. When the trustees of the University of Pennsylvania decided to establish a dental department therewith, the question arose in their minds whether they would confer upon the dental graduates of the University the degree of M.D., or the partial degree of D.D.S. The first would necessitate the attendance upon three full courses of lectures. (It is well known to all of you, I presume, that the medical course of instruction has been extended to three years, instead of two.) Now the question presented itself forcibly to their minds whether they should compel the dental student to attend the three years' course and take his medical degree with the others, or whether for the present it should remain optional with the student to attend two courses and receive the partial degree of D.D.S., and while they strongly favored the former, they finally decided to leave the choice with the student. The plan now is that the dental student take the first year's curriculum, which is identical with the first year's studies of the medical class; the second year, if he desires to become a candidate for the dental degree,—he merely repeats his first year's studies. But if, on the other hand, he decides to take the three years' course, with the

medical degree, he joins the second year medical class, and the next session he takes the third year curriculum. (The courses are graded.) He may graduate in dentistry at the end of the second year, receiving the degree of D.D.S., and at the end of the third year take the medical degree. Time will prove whether the dental profession is ready for a full medical education for the dental practitioner, and if its members are ready, the University of Pennsylvania is willing to make the change. Facts are stubborn things, but we have to deal with facts. How many students who come forward to take a course in dentistry are prepared financially to avail themselves of the full medical curriculum, involving an increased expenditure of time and money?

If we should follow out the course which Dr. Fillebrown has suggested, it would take at least ten or twelve years to perfect one's self in the collateral branches. So with Dr. Wetherbee's course. The student would be forty or fifty years of age before he would have completed his studies, and then after living out the best part of his life, he would be ready for his degree. These are practical facts, and they must be met fairly and squarely. For my own part I would say, make the student graduate in medicine first, and require him to be thoroughly up in all its departments, and then let him practice dentistry if he desires. It is this that the University of Pennsylvania is coming to. For the present we will confer the partial degree, but we trust the time is not far distant when the profession will be ready, and will require us to abandon the partial degree, and then it will be willingly done. It may be that the next session will require a full medical course.

Dr. Atkinson: I wish to say something with regard to this question that is so complicated and profound and manifold in its modes of presentment. Are we likely to be benefited most by the institutions that have been built upon effete and exploded theories, and that are continually inaugurating and enforcing them in their teachings, with all their prejudices in favor of the darkness? I wish to say, dentistry is medicine. I leave that out of the discussion. If we have had very little of medicine in dentistry, and very little apprehension of how a tooth should be filled, of what were the causes or the incidents that occasioned the necessity for us to operate or manipulate or prescribe for it, that only is for our own consideration, as honest men, in dealing with our patients.

Where shall we be most likely to get the truth? In this correlation of the vast mass of nonsense! or in the clear-cut perceptions where we see the sharpest light defined on the very point we wish to get at! We are here as *dentists*, (as my friend Dr. Taylor said,) because of our individual action as against the opposition of "Old Medicine," that would not accept us and teach us. Was not the kindly angel doing better for us than we had any expectation of? Were we not blest in that opposition, and have we not grown rather in consequence of it to occupy the position we now hold? By the grace of heaven we have been made to work better than we knew.

How shall we so arrange it as to utilize what there is advantageous in the medical colleges and leave out that which is detrimental?

We shall have to do it with the microscope and chemical retort, and we have the material among us to prepare for it, and I hope we shall give encouragement to all efforts that are made to arrive at the truth.

Why do the medical colleges ask for the patronage of students? Is it because they are so imbued with the truth and so overflowing with *legitimate lore* that they are bound to spread these broadcast? I am sorry that my guiding angel won't enable me to say that it is so. I have a little suspicion that the dollars and cents have something to do with it.

The increase of respect for the practice of dentistry, among medical men, is due more to this action of those universities that have instituted professorships for our specialty in their faculties, than to any desire to place the department of dentistry on an equality with medicine.

Dr. SPALDING: I shall have to pass very hastily and briefly over many topics I would like to spend time upon, but I want particularly to say a few words in relation to the college of dental surgeons, with which I happen to be connected. This college makes it possible for a competent candidate to graduate without attending a course of lectures — and why? Because it recognizes the fact that there are a large number now belonging to the dental profession, and who are creditable and useful members thereof, who did not take courses, and consequently do not hold degrees. It recognizes the fact, also, that there exists a tendency to close all

doors of access to these worthy gentlemen, and lest they might be entirely shut out, it determined to open the doors a little wider than they have previously been. That is the view the college took, and I believe it is a just and righteous one.

On this subject of medical education, and of whether dentistry is a branch of medicine, there can be but one opinion, and there has been but one that I know of. The question is not as to the abstract fact of whether dentistry is a branch of medicine, nor whether it is desirable that every practitioner of dentistry should have a complete medical education. The only question is, how far it is possible for us to enforce such a rule. We must not rush to an extreme in this direction, which will drive from our doors a large majority of those who are ambitious of becoming dentists, by making the means of acquiring a degree so difficult that they cannot accomplish it at all, and thus drive them away from the schools. The result would be that after spending a short time in some private office, they would be practicing all over the country. We cannot prevent that kind of thing. It is taking place to a great extent to-day, even with the facilities that are afforded to young men to acquire a dental education. A great many are now practicing without proper qualifications. If we too positively advance the standard of acquirements, we will only increase this practice of what we call outside quackery. The present status of the dental profession is due largely, if not mainly, to the existence of this system of dental education which we have organized and carried forward with such marvelous success and with such wonderful results. Nothing else compares with it. Take the profession as it stood a quarter of a century ago, and see the position it occupies to-day. Compare it with any of the other specialties of medicine and where does it stand? Dentistry is a much larger specialty than any other, and it is so large that it is impossible to incorporate it into a body that is only a little larger than itself. The consequence of such an attempt would be that we would sink in the estimation of the people and in our own self-respect, and we would retard the progress of dental education by any such step at this time. The time may come when such a step would be proper, and when it does I would advocate it. Take to-day the relative standard of acquirements between the graduates of dental schools and those of medical schools, and we will find that dental colleges

are more particular as to the previous acquirements of their students than are medical colleges, therefore in that regard we are in advance of them at this time. If, therefore, we allow ourselves to be swallowed up in medicine, we shall go down in that regard. And when you come to the qualifications for graduation, the same remark applies. The dental students that are graduated from the colleges in this country to-day average higher in medical as well as dental acquirements than do the medical students. The legitimate consequence and inevitable result of connection with medical schools will be precisely what our friend Dr. Fillebrown has pictured, viz, the abolition of dentistry as a distinct profession. The medical will entirely absorb the dental profession. Dentistry will cease to exist as a distinct profession. If that comes about, what else follows? If our schools are to be fused with medical schools, does it not follow as a legitimate consequence that all our institutions must fuse in the same way? Does it not follow that our organizations, our societies, must fuse in the medical societies? Does it not also follow that our national bodies must fuse with the medical national bodies? We are too large for this. All the other specialties do that, we know, but they are smaller. I believe that we are old enough and large enough to walk alone.

Dr. M'Quillen: The arguments presented in favor of a thorough medical education on the part of dental students are plausible. The question is, whether the system proposed is practicable or not for the mass of students, and will prepare them for the practice of dentistry. One of the gentlemen said, "It is a pity dental colleges were established, and now stand in the way of dental departments in connection with medical colleges." No one familiar with the history of dental education would have made such a remark. It is rather a pity that the prejudices of medical faculties stood in the way of establishing such departments long ago. Many years ago, before dental colleges were thought of, overtures were made to the medical colleges by leading members of the dental profession to enlarge the curriculum of study so as to embrace at least two chairs to be devoted to teaching dentistry, and a most excellent paper was published on the subject at that time by Dr. E. B. Gardett, of Philadelphia, but the trustees and faculties opposed the innovation, and the dental colleges came into existence as a *necessity*. Subsequent to this a resolution was adopt-

ed by the American Medical Association (in 1852) "That colleges of dentistry are not recognized by this association as among the bodies authorized to send delegates to its meetings," notwithstanding the fact that the delegates who presented these credentials were men of culture, leading positions, and *regular graduates of reputable medical colleges.* Thus denied an opportunity for education in the medical colleges, and the recognition of medically educated delegates from the faculties of dental colleges by the National Medical Association, there was but one course open for the education of those who desired to enter the ranks of the profession, and that was in the dental colleges. This work has been done in a manner that commands the respect of thoughtful men at home and abroad, and attracts students from every quarter of the globe to our dental colleges. Many of these are medical graduates of the universities of Europe, and they reverse the course pursued by the young medical graduates of America, who go to Europe to complete their education in the universities from which our students come. At the Centennial Exhibition it was admitted without question, by foreign judges and visitors, that the American machinery exhibited far surpassed everything presented from abroad. This was due to the fact that in developing the resources of a new country, our necessities have made an unceasing demand upon the ingenuity of the people, and have induced large numbers of men with acute intellects to devote their attention to the invention of new and the improvement of old machinery. The same influences have given to American dentistry the advanced position it occupies in the estimation of the world. There is a general impression that the teeth are worse here than in Europe. Whether this is so or not is a matter of question, but there is no doubt of the fact that from the highest to the lowest there is a more general recognition of the value of the teeth, and a greater care and interest felt in their preservation here than elsewhere. This has given occupation to, and developed the skill and stimulated the inventive faculties of, many active minds engaged in the preservation of the natural organs, and the construction of artificial substitutes. After many long years of hard work, self-sacrifice and anxious waiting on the part of those engaged in the struggle, the success attending the dental colleges has attracted the attention of the trustees and faculties of the medical colleges, and some of them have decided

to grant the boon denied before, and establish chairs from which dentistry may be taught. Is this due to a more lively interest in the welfare and advancement of our profession? If so, it comes after a very long probation with the work done by other hands. Whatever the motives or objects may be, the important and vital question to the profession and the dental student is, will *better* opportunities be presented there than in the dental colleges for becoming qualified for engaging in the *practice of dentistry?* This the future must determine. To be consistent and prove really in earnest, however, institutions that advocate a higher standard of education, and demand of medical students three years of study and attendance upon three winter courses of lectures, should require the same of dental students as Harvard Dental School does.

Dr. INGERSOLL: I am well aware that in the constitution of this society dentistry is regarded as a specialty of medicine. That term is used also in the reports. I have heard it over and over again. The term medicine is ambiguous. It has a double meaning, and can only be understood by an explanation of the meaning which is intended, whether it shall be understood in its technical or in its popular sense. If by medicine is meant all that pertains to the human organism, I will admit that dentistry is a specialty of medicine. But the term medicine as popularly understood, as interpreted in the curriculum of our medical colleges, by the medical faculties, and in the medical organizations that exist throughout the country, does not embrace dentistry as a specialty. Turn over the books of medicine — how many pages do you find devoted to the teeth? Is there anything in the curriculum of a medical college upon which you can base the practice of dentistry? Is there any medical man who has ever graduated from a medical college who could be considered, in any sense, qualified to enter upon the practice of dentistry? He *is* considered qualified to enter immediately upon the practice of the other specialties, but in no sense is he considered qualified to enter upon the practice of dentistry. Why? Because the former are regarded by the medical profession as specialties of medicine, and because the latter is not regarded by the medical profession, or in medical literature, as a specialty of medicine. I am for maintaining the dental profession distinct from the medical. I am for independence, whether we live or die, sink or swim; for the reason that

we have risen to our present position by independence. The dental profession is *not* an outgrowth of the medical profession,—is not a child of medicine, as popularly understood.

Dr. JOHN ALLEN: To show that we have the entire confidence of the medical profession, let us bring the matter home to ourselves. Medical men have occasion to have dental operations performed, as well as other folks. They come to us with the most perfect confidence, that when we tell them this, that or the other must be done, they yield at once. We never have any discussions on the subject with our medical brethren. They come with the utmost confidence in us, that what is right we will do, and consequently they give themselves entirely up to our care, and when they have cases, (and they do occur again and again in our larger cities,) where they are at a loss to know what to do, if disease is connected with the head, jaw or face, they at once yield to the better judgment of our dental practitioners.

Dr. CROUSE: This resolution is, to add a dental department to medical colleges. We are fighting against such a measure in Chicago, and have been for years, to keep the medical schools from adopting a dental department, and forcing upon us a dental college which the profession does not need. The same movement is going on in Iowa. There are men in both the dental and medical professions that are trying to establish one-horse dental colleges. We have enough of these already, and I think the expression of the association that we do not want any more medical schools to add dental departments to their institutions unless they make a complete course obligatory, would have a good effect on such medical schools.

REPORT OF COMMITTEE

ON

THERAPEUTICS.

By FRANK M. ODELL, Chairman.

ALL departments of medicine, and of each of its divisions, have a disposition so strongly marked, to glide into each other, that to sharply draw the separating line is often a merely arbitrary measure. Just where normal histogenetic and histolytic actions cease, and inflammatory action begins, is a point as yet too fine for pronouncement. In like manner the exact dividing line between the inception of the acceleration of reparative or inflammatory action, and the corporeal state nominated "fever" is often very misty; but so close is their relationship that it is not too much to say that every interference with the regular ebb and flow of the various nutrient currents is productive of a somatic or local condition simulating or directly resulting in a more or less pronounced feverish manifestation.

So long as the regular processes of nutrition proceed in rhythmical order, the temperature of the body remains at a point most conducive to its functional integrity; but the slightest interference, whether from clogging of the various debouchures of the body, or from obstruction of function of organs deeper seated, induces such a struggle for resumption of the normal interchanges as to immediately call forth potential energy sufficient to restore the equilibrium.

Every such systemic exhibition of intensified force (nominated *vis medicatrix naturæ*) being an increase in the rapidity of moleccular interchanges (always productive of development of heat), immediately causes a rise of temperature in the locality where the acceleration of action takes place; and this thermic elevation is ordinarily immediately compensated through the various *media* by heat dissipation.

Any obstruction to this heat dissipation, whether local or somatic, tends to induce fever; hence these pyretic conditions are the most frequent morbid states falling under medical observation, and possess a most powerful attraction to the medical mind.

A bodily temperature of 98.5°–101.5° Fahrenheit, what is termed feverishness, very often obtains in the cases of children, without necessarily implying danger; and yet a very slight elevation above this point indicates serious complication, and at 107°–108.5° Fahrenheit, the poor body has attained a febrile altitude at which existence is possible for only a brief period, and recovery hardly to be thought of.

At the normal temperature of the body oxygenation of muscular tissue goes on very slowly; but with a sustained high temperature the blood-current becomes *filled* with débris of nitrogenized tissues; and the rapid wasting away of the sarcous elements during high fevers is one of the most astonishing manifestations with which the medical mind is familiar, and one which to the *patient* seems the most disgustingly unnecessary; their sudden loss of muscular power being always the, to them, most unaccountable.

This bodily state (muscular weakness and sustained high temperature) indicates the typhoid condition; not necessarily typhoid fever or typhus fever, which are the result evidently of a specific poison, but a condition calling for great conservation of the powers of nutrition nevertheless, and indicative of the mode of treatment to be pursued, not only in this but in every case so far as temperature is concerned.

Increase of bodily temperature must obviously result from one of three sources, viz: (1) Augmentation of heat-production; (2) diminution of heat-dissipation, or (3) a combination of increased production and impaired dissipation of heat.

Now what I wish to impress upon you at this time is *doubtless* just what you have always known, and in a measure practiced, but perhaps I can throw a little more light upon the *reasons* for that practice, and so make it more consonant with the indications which in each case present, and more generally and speedily successful; and in order that you may the better comprehend the therapeusis, I beg leave to lay before you the basis upon which the treatment is built.

Biolychnion (from the Gr. βιος 'life,' and λυχνιον 'a lamp,' ani-

mal heat or vital heat,) is that temperature of the body which in the normal or healthy condition is always maintained (clothing of course being a conservating factor) regardless of the temperature of the surrounding atmosphere.

This normal temperature is marked by Fahrenheit's thermometer at 97.5°–98.4°.

Within this slight range of temperature is health.

A rise or fall of one degree is temporarily induced by ingestion of food, by exertion, by stimulation, or other slight causes, but any depression below 97.3°, or any elevation above 99.5° Fahrenheit, is, if *persistent*, a sure indication of disease.

These facts, collated from a very large range of hospital practice, prove beyond doubt the value of the thermometer as an auxiliary of the first magnitude in diagnosis.

Indeed, Dr. Alfred L. Loomis, of New York city, a physician of remarkably extensive experience, speaks of thermometrical observations as follows:

1st. An abnormal temperature determines the presence of some disturbance in the animal economy.

2d. Thermometrical observations aid us in discovering the *laws* which regulate the course of certain diseases.

3d. When the normal thermometrical course of a disease has been determined, its diagnosis is simplified.

4th. The thermometer indicates quickly and certainly any deviation in the course of many diseases (meaning those whose course *has* been determined), the transition from one stage to another, and the commencement of convalescence.

5th. It reveals the occurrence of complications.

6th. The height of the temperature decides the severity and danger of a disease.

7th. It often reveals the imminence of a fatal termination.

8th. It sometimes shows the impossibility of the continuance of life.

9th. It is an important guide as regards the effects of remedial agents.

10th. Certain degrees of temperature indicate fever.

The maintenance of this point of biolychnion, which is of course in a state of constant oscillation, is due to a variety of inciting circumstances, the study of which, with the proper appreciation of the

signification of each, gives us the key to all treatment having for its object the control or direction of these processes; and the measure of our ability in practice depends entirely upon our regular apprehension of these phenomena.

Movements among masses, molecules or atoms, whether of construction, aggregation or destruction (or separation, elimination and extrusion), result in the evolution of heat. By a natural inference we apprehend that from the time of prehension of ingesta, through all its changes of location, in insalivation, deglutition, digestion (which comprehends manifold combinations and separations, both mechanical and vito-chemical, including chymification, chylification and absorption), to assimilation which implies nutrition and oxygenation, oxidation and disintegration which involve resorption of hystolytic elements into the circulation, and transportation to the various somatic emunctories, where, by the selective power of the epithelial elements constituting the glandular apparatus charged with these functions, until secretion and excretion close the circuit, all of which movements include polarization and depolarization, heat is freely evolved, which, being the result of the combined action of ALL the molecules, would serve to maintain the temperature far above the point compatible with corporal integrity, were it not for most wonderful provisions for heat dissipation, which by *counter* action serve to maintain the happy norm wherein lies safety to the organism.

By a little reflection, you will perceive that in the above correlation is implied, if not expressed, all the known processes whereby not only the *immediate* wants of the system are supplied, but provision for a steady and unintermitting supply of heat effected.

It is not necessary for me to go into a categorical enumeration of the processes for storage of glycogen in the liver, and liberation of hydrocarbons from sarcous and adipose tissues; but I will at once proceed to a consideration of the provision made for heat dispersion, which in our treatment for fevers is a vital point for medical consideration.

Heat dissipation is effected normally and principally by the skin, and to a considerable extent by the respiratory tract. Circulation of the blood in the cutaneous vessels and in the pulmonary capillaries results in considerable radiation of heat into the atmosphere: free blood-supply rouses the sudoriparous glands to action,

and by evaporation of the product of their functional activity very considerable heat-dissipation follows. Dilatation of the cutaneous vessels, permitting a great flow of blood therein, results in increased radiation of heat, and contraction of the internal capillaries in decreased heat-production.

Cold drinks reduce temperature by direct abstraction of heat, and perhaps by direct addition of the principle of cold.

Warm drinks, which at first raise the temperature, if continued until the action of the sudoriparous glands is accelerated, will afterward depress it in consequence of increased transpiration.

Massage (from the Gr. *μασσω*, to knead), being the manipulation practiced by professional rubbers, or magnetists, and at the Turkish bath, is another most excellent mode of reducing excessive heat-production, and promoting heat dispersion, or *vice versa*, according to the requirements of the system, on the principle of restoring tonicity, whereby the organism is enabled to resume control of the functioning activities.

To make this proposition more apparent to the minds of those who have had no responsible experience in this direction, I might be pardoned for referring to the treatment which your essayist adopted when suffering from that, to most minds, alarming exanthematous visitation (I purposely avoid the term "affliction"), small-pox.

Before the formation of any blebs, and after two days of racking pain in every muscle, and apparently in every bone, together with a feeling of tendency to delirium, as evidenced by cephalalgia of a dull, unendurable variety, accompanied by great elevation of temperature, the headache being quite evidently due to circulation of detritus of sarcous elements in the blood-current, as well as to the thermic elevation, thorough ablution with warm water and soap, preparatory to the religious duty of "massage," which under my direction was efficiently performed by a faithful and anxious wife, and followed by another washing with warm solution of pure spirits (commercial crude alcohol), as a cutaneous stimulant, resulted in immediate relief from all the distressing symptoms, together with a plentiful crop of cuticular elevations, which made their appearance within the ensuing six hours. The treatment had been addressed simply to the reduction of temperature, and the result which immediately followed, due doubtless to profuse dia-

phoresis, by the determination of the fluid constituents of the lacunar and vascular areas of the body to its cutaneous surface, whereby the glands took on an intense vicarious action, resulting in the plentiful production of blebs, and their gradual attraction of the histolytic products of the febrile action, which by relieving the other emunctories of the congestive crowding of toxic-egesta, and by consequence of the necessity for excessive action, naturally resulted in resumption of normal functional oscillations of endosmose and exosmose, secretion and excretion.

The subsequent treatment of this exanthematous fever consisted in the careful surgical evacuation of each bleb, when filled, of its contents, so as on the one hand to avoid the action of the escaping escharotic fluid upon the adjoining healthy cuticle, which is readily accomplished by means of minute pieces of paper applied to the margin of each bleb as opened, until no more fluid extrudes, and on the other hand, to avoid pressure upon the blebs, the deep extremity of which, resting upon the highly sensitive papillæ of the true skin, would under pressure from rubbing or otherwise wound the same, and produce scar-tissue where there would otherwise be no mark remaining.

Subsequently the surfaces of the blebs should be kept constantly bathed in some emollient, as glycerine and water, or vaseline, which relieves the superficial epithelial scales of their stiffness, and constant *consequent* inclination to augment the systemic inflammation by epidermical irritation.

By avoiding nitrogenous food, and persisting in the employment of the most perfect sanitary regulations, and avoiding all excitement, the latter stage of the treatment becomes a mere exercise of patience, abstinence, and avoidance of thermal variations, neglect of which precautions might protract convalescence.

Covering the face with something to exclude the atmosphere, as a *mask* of dough, has been much practiced in this connection; but the weight and points of attachment of the mask frequently *cause* the very scarring which it is designed to prevent.

During the progress of the fever, cooling ingesta, such as apples, tea without milk or sugar, and stewed fruits, are in order, and act kindly, being likewise very grateful to the palate; much of the cooling properties of such food being due, I have no doubt, to the influence of the action of color,—the blues and the purples.

For a novel and philosophical exposition of the influence of color upon all natural processes, I refer you to a very beautiful work just published, entitled "Principles of Light and Color," by E. D. Babbitt, D.M.

With your permission, I will again refer to the clinical thermometer; in order to a complete outline of the method of using which for diagnostic purposes, it must ever be borne in mind that a single thermometrical observation is an important element in diagnosis only when taken in connection with other physical signs. The pulse and number of respirations should always be noted at the same time. *Frequent* observations should be taken at regular diurnal and nocturnal intervals, so as to note the *rate of variation*, as well as the mere *fact* of variation.

These observations should be made at any point of the body where the instrument can be entirely enveloped by the tissues, the mouth being in this connection, as in history or narrative, the least reliable.

In the analysis of histolytic products, we have in the single item of renal excretion urea (so long as no renal complications exist) a guide to the biothermal condition of the patient, quite equal in accuracy to the thermometer; the excess of excretion of urea above the normal elimination (which in different individuals ranges from four hundred to five hundred grains daily) marks the severity of the fever, or the intensity of the interchanges induced by this morbific presence.

In the direction of apyretic agents, our materia medica *overflows* with diaphoretics, depressants, various methods of applying cold, and the more scientific methods of acting upon the circulation, and through *it* reducing the pyresis.

Some remedial measures are addressed to decrement of heat-production, others to increment of heat-dispersion, while others depend upon the cooling effects of increased transpiration. Even bleeding and leeching are excellent means of reducing or diverting inflammations threatening congestions or fevers.

Acids, both mineral and vegetable, present efficient defervescent agents, and citric acid is almost specific in scurvy.

Fresh air and sour wine have, single handed, coped successfully with the fever fiend.

Dilute phosphoric acid, aromatic sulphuric acid, and hydro-

chloric acid, are agents in high favor with many practitioners. Acetate of ammonia is a favorite remedy, especially for children.

Those diaphoretics which are at the same time depressants, as ipecacuanha and tartar emetic, are exceedingly effective; but aconite, in its action in controlling inflammation and concurrent fever, is one of our most wonderful and reliable remedies; it should be administered in the early stages of the pyrexiæ, half a drop to a drop of the tincture of the root in a teaspoonful of water every ten minutes for two hours, and afterward hourly.

Chloral hydrate, which is in high favor with many, does not enjoy my confidence to the same degree, because, acting by paralysis of the nerve-centers, it is apt to astonish the patients by their translation into the next higher sphere.

Such measures as have been indicated are proper in cases where the temperature is sustained in consequence of defective heat-dissipation where restoration of dermal function is sought; but in many fevers we have a plentiful transpiration accompanied by increasing temperature. Such a case I had last summer, where while talking with the patient, who, though very weak and anxious, was still able to be about house and attend to her duties, the water would actually drip from the arms and head. Here we had plentiful provision for superficial heat-dissipation, but increase of heat-production to an alarming extent nevertheless. This was a case directly induced by a combination of irregular and inappropriate food, frequently omitted altogether through disgust at the surrounding filth, malarial emanations from garbage stored in most unlikely places, and elevated atmospheric temperature, with slight constipation.

My first blow was struck in this latter direction by a cathartic, followed next morning by a draught of citrate of magnesia and large draughts of cold water. This treatment was immediately supplemented by my sheet anchor in such cases, quiniæ sulph., administered in large doses until cinchonism is produced; in this case requiring only sixty grains, administered in one dose of thirty grains and three doses of ten grains each, and all within twelve or fourteen hours.

In a case of parturition I have likewise administered quinia with marked benefit to the patient, reducing the temperature from 102° Fahrenheit to 99° within two hours.

In some cases quinia seems to be rejected by the absorbent vessels. In such instances administration in milk or soup will often promote its ready assimilation; but where it is absolutely rejected, as after long use it sometimes is, or where it is productive of unpleasant symptoms before accomplishing the object sought, it can frequently be substituted by salicylic acid, which is apt to meet in such instances with a kindly reception, and which in drachm doses produces a decided thermic depression. A combination of salicylic acid with quinia also acts charmingly.

But in the proper regulation of bathing appliances, with an intelligent use of the thermometer, which includes consideration of the causes of the pyrexia, and the consequent best manner of combating it, I place quite as much reliance as upon medication.

And we are now approaching an era when the proper use or direction of the so-called "finer forces," together with a study of the influence of light and color, bid fair to, in great measure, usurp the field now occupied by the more ponderable therapeutic agents.

Thanking you for your kind attention, I beg to apologize for the length of the paper by explaining that, owing to a pressure of duties, I had not time to make it shorter.

DISCUSSIONS.

Dr. Spalding: I wish to say, in regard to the able paper which has just been read, that it contains so many details that it is impracticable to discuss all its points at this time. It is well known to many of you that my therapeutical views do not agree with those contained in that paper, and therefore, in a spirit of kindness, of investigation, and of a search for the truth, I shall hold it my duty to review that paper to a considerable extent after it appears in print. All I want to do at this time is to call attention to one important therapeutical agent in cases of exaltation of temperature, that we commonly denominate fevers, which the writer omitted to mention, probably because his attention has not been called to it. I refer to *Gelseminum sempervirens* (the common yellow jasmine) as being superior to aconite or to any other remedy known to me for general administration in fevers. It should be given in one or two drop doses of the tincture, and may be given with a frequency in accordance with the severity of the case. If the

case is severe, the administration of the dose may be repeated as often as every ten or fifteen minutes, extending the period of administration to two or three hours as the symptoms subside. Where the inflammatory symptoms are general, this remedy is, in my estimation, far superior to any other that has ever come to my knowledge. For local inflammations aconite is its superior.

Dr. Flagg: I have found aconite to be my best antiphlogistic. I have experimented with jasmine for many years, and although it is in some instances an excellent remedy where aconite fails, I have nevertheless found it a very ticklish medicament. It comes under the category of hydrate of chloral, and oftentimes it will trip you up, and I advise that one should be well prepared before he prescribes such medicines. I cordially indorse the practice of the gentleman who read the paper, and would add that if I were very sick and likely to die, I would not object to having him take care of me.

Dr. Atkinson: This paper is a congeries of correlated truths, the result of long and honest experience, but has it touched a principle,— has it led us one step beyond empyricism? Do we know anything about the how and the why of the results that follow the administrations of remedies that have been so magnificently presented to us this morning? Until we *know*, we are under the ban of generalization, and lost in clouds of ideas without the differentiation and specification of the modes of motion that are involved in the manifestation of the symptoms that we observe. There appears in the report this statement — "that when the system gets control of the functions—" I don't think the writer meant to say that. The system is itself the result of functional action in that peculiar process that constructs it for specific purposes; and it is only so far as to the appetency to receive the modes of motion that operate the functions of the body that the system can be said to have anything to do with the activities within it at all. This brings us to the point that constitutes the derangements presented so beautifully. How is it that the agents administered have been observed to lessen or exalt the temperature of the body? How do they thus present these favorable or unfavorable manifestations? I will not go through the whole catalogue of names of the groups of remedies that have sometimes been polypharmic (made up of many constituents) and called one remedy in therapeutics, or to

show how in even dual agents the action upon the functions is manifest. What is tonicity? We say we give tonics, and we give sedatives. What is tonicity and what is sedative action? We must discriminate a little more closely if we are ever going to attain the ability to comprehend therapeutics, and be masters of the situation. Tonicity means the bringing about the tone of the vessel, or the muscle in the vessel,— for to say the vessel I am contradicting myself and am doing as I said before,— merely babbling, because of the bad habit adopted from my false teachers. Tonicity is the tension of vaso-motor nerve. One of the differentiations of the nervous system is the vaso-motor twigs, in which the neural current within the system acts upon the protoplasm of the muscular fibres, constituting tonicity.

Therapeutics has been defined. I shall call your attention to what therapeutical action is. We are dealing with the kind of functional action that is induced by restoration of lost balances in the machinery of the modes of motion that we call function, so that therapeutical action is the reëstablishing of the normal activity, and the therapeutical agent is that agent which is brought into such relationship with the organization as to operate upon it in three ways. One has already been indicated by that of tonicity, which is the making up of the tissual elements by the synthesis which constitutes the elements of the tissues in molecular mass, and that is why globulin (or whatever you please to call it — the complicated salt of iron that gives the red-blood corpuscles their color) enables the molecular mass to receive and appropriate the modes of motion that are combinatory of its mass, and even of the atomic constituents of the same. Therapeutics, then, is the proper feeding of the organization by which the needed pabulum can be brought to bear upon the constituency of the elements of the tissues, the globules. There are two other points of movement still to be considered; one is that which will offend and depolarize, and shut up all these channels, so that there shall be no further appropriation of the ferric salts. The next point is, there is such a kind of therapeutics as is adventitious,— that stimulates adjoining healthy territories to so operate as to have an excess of their energy to supply all the weakened territory.

Has not that simple idea often been covered up in all our past instruction in medical literature?

What is fever, and how many kinds are there? There cannot possibly be but one kind, and all the differentiations of that are but degrees of demoniac possession, constituting the so-called varieties of fever. They talk about intermittent fevers, and typhoid fevers, and sthenic fevers. *Sthenic* fevers! Heaven deliver us! Sthenic weakness; is not that bad — strong weakness! And they say asthenic, just as if any diseased action could be anything else than asthenic. Chemists know that. The point is that we have acids and alkalies. We reduce all our food elements to acids or alkalies. Acids operate so as to neutralize alkalinity, and the alkalies to neutralize acidity, so that when from any overwork, or the inception of any poisonous substance admitted into the circulation, the territories set up combustion, and there being not enough of the combustible material (hydro-carbons) in the flesh of the part to satisfy the desire of the oxygen to constitute a complete combustion, it seizes upon the elements in the organized tissue; in other words, it seizes upon the nitrogenous elements in the muscular and albuminoid tissues, and that gives you fevers. Now do you know why acids cure fevers? Because the acids supply the necessary elements to have the combustion go on in the fireplace, and not outside of the fireplace and in the house. You know there are three alkalies necessary in the human body — potash alkali, soda alkali and the ammonia alkali. When they are acted upon too much by acids you get what are called typhoid fevers; and when I say acted upon too much, what do I mean? I mean that when there is not enough oxidized material in the circulating system, intra-vascular, extra-vascular and extra-corpuscular tissue lying within the interspaces of what we used to call inter-cellular spaces, then the oxygen seizes upon the oxidizable element of the tissue and produces the mischief. Now do you know why some drunkards do not die early? Do you know why gourmands live as long as they do? Because they have stuffed themselves with combinations of hydro-carbon to such an extent as to satisfy the demands of all the oxygen they take in when they breathe so very liberally, and thus the tissues escape being operated upon.

REPORT OF COMMITTEE

ON

DENTAL LITERATURE.

By C. D. COOK, Chairman.

DURING the year which has passed since the last meeting of this Association several works pertaining to the dental specialty have appeared, as well as some new ventures in dental periodical literature. Of the dental works, four are in the English language, one being American.

The American work just referred to, although, perhaps, not worthy of so high-sounding an appellation, is yet, in its aim, of considerable value. It is a small pamphlet for popular instruction, entitled, "Our Teeth," published by the Illinois State Dental Society. This little work is intended for gratuitous distribution to the public, and aims to give such practical information concerning the teeth as may induce the best results from personal care and attention. While it does not, of course, teach everything concerning the teeth, or define or detail all dental affections, there is sufficient information in its pages to enable any intelligent person to know that there are various causes for dental disturbance which are amenable to skillful treatment, and to indicate to him when it is important that he should seek professional advice. The work is clearly and concisely written, in a style not too familiar, while, also, not excessively professional. Such a work will, it is believed, be productive of much good.

"A Treatise upon the Anomalies of the Dental System in the Human and Other Mammalia," by Dr. E. Magitot, edited by G. Masson, Paris, 1877, has been published in the French language, and is a valuable acquisition to our scientific literature. It is a quarto volume of over 300 pages, twenty of which are given to illustrations of the text, each page containing from eight to twenty-

five fine engravings, most of which are designed from nature. The work is the result of ten years of patient and minute research, and has been deservedly "crowned by the Institute of France." It is the first publication embracing the whole field of dental anomalies which has yet appeared.

In introducing his subject the author discusses, under the heading "Generalities," the general aspects of dental anomalies, and furnishes their statistics and classification. He then presents them successively in the vertebrates, the lower mammals and the human races. Here the work touches upon some important and recent questions in the domain of anatomy and physiology (anthropology) in fixing the laws of *number* and of *situation* of the dental organs, and their morphology, and at the same time considers the "phenomena of reversion," or return to the original type. Another paragraph treats of the *mechanism* of the formation of anomalies, viz., *special teratogeny*. This chapter closes with showing the connections which the different deviations present, together with the production of the lesions, either medical or surgical, which arise in consequence.

Dr. Magitot divides his subject into nine classes. Of these we will consider, first, the chapter commencing with the anomalies of *number* in man and the domestic animals. Then follow the deviations from the normal position, or *heterotopia*, and all their pathological consequences, of which some very curious and interesting examples are given.

In his treatment of the teratology of the dental system, the author borrows much useful information from the collateral sciences, while he lends to them many valuable facts and applications. To the zoologist and naturalist he presents the form, number and direction of the dental organs, and shows that these are obedient to the special laws of evolution in the successions of beings. He indicates the morphological modifications, from which the simple tooth of the inferior vertebrates is elevated and developed, by degrees, to the complexity and perfection which these organs present in the superior animals. He illustrates, in fact, the doctrine of primitive type,—of dental unity.

In this scientific and complete exposition of dental anomalies the author has succeeded in bridging a broad chasm hitherto existing in our literature. Instead of accepting the teratological classi-

fication of Isidore Geoffrey Saint-Hilaire (who was guided by the principles before adopted by his father, and which may be called the "anatomical method"), Dr. Magitot has adopted what he styles the "physiological method," and has described dental anomalies under the following heads: 1st, Anomalies of *genesis*, which include the deviations in *position* and *number*. 2d, Anomalies of *nutrition*, including those of *form*, *size* and *structure*, and the aberrations in the intra-follicular life of these organs, which produce the odontomes and the cysts. 3d, Anomalies of *development*, which comprehend the diseases in the eruptive stage, and the reciprocal direction and disposition of the teeth.

In Section II, under the head of "Anomalies of the Dental System in the Mammalian Series," the author says: "The dental system considered in the mammalian class manifestly presents, in all its characteristics, a certain *fixedness*, which decreases sensibly as soon as they descend in the scale of vertebrates. The *cone*, more or less sharp, is the rudimentary primitive form of the dental system — the primordial type — the unity or archetype — upon which seems to be constituted the ascendant series of the morphological modifications of the dental system." "It is," he says, "what we call *the conoid type*, toward which we observe the tendencies to revert on the part of the superior forms which are struck with teratological aberrations."

This view is supported by a close analysis of the teeth of various fishes, reptiles and animals, including those of the monkey and of man, and in comparing these the author sustains his opinion by giving the histological origin of the various structures composing the teeth, and their similarity of origin with the hair, nails, etc.

The next section is devoted to the anomalies of the human denture,— noting the changes observed in the different races and in different epochs.

The fourth section is headed "Teratogeny of Dental Anomalies," and treats of the many causes which may interfere with the normal genesis and development of the teeth, to produce a modification of form, etc. The comparative teratology of animals, fishes and man is shown. Here the author briefly explains the origin of the enamel-organ,— not alone of the normal number of teeth, but of the supernumeraries (adopting the theory of Kollman as to the genesis of the latter), and notices the more or less mod-

ified forms which these anomalies assume, and their sometime tendency to return to the fundamental, primitive or *conoid* type.

The third section in chapter 2 is devoted to *augmentation in number*, with tabular illustrations.

We have given a hasty synopsis of the contents of only a third of the work of Dr. Magitot, but even so little is sufficient to indicate the very great value of this treatise. Indeed, it is a work of such magnitude and scope, treating dental anomalies, as it does, from physiological, pathological and surgical standpoints, that we must confess our inability to do it adequate justice in this writing. That it is far in advance of anything which has preceded it upon this subject cannot, we think, be denied; and while it may not particularly aid the skilled American dentist in his practical treatment of anomalies of position and direction, yet, from the standpoint of science and theory, there are few who will be unable to derive immense benefit from its clearly-written and admirably-arranged pages. To this end, in English-speaking countries, it is to be hoped that a good translation may soon be put into our hands.

M. Valérien Pietkiewicz, of Paris, is the author of a work on "Alveolo-Dental Periostitis," also in the French language. This makes an octavo volume of two hundred pages, and is of sufficient value and rank to deserve notice. The work is evidently the result of much laborious study, but space forbids more than a résumé of its contents.

The first twenty pages are devoted to the anatomy (normal and pathological) and physiology of the periosteum, and a description of the structures composing the teeth. This is followed by about forty pages upon the "complications" incident to or resultant upon alveolo-dental periostitis.

The chapters upon Etiology, Diagnostics, and Treatment, occupy over one hundred pages, and these subjects are treated methodically and with great minuteness of detail, and also, we may add, with considerable ability.

Part 2d of the work, which constitutes its remainder, is given up to what the author styles "Observations"—a summary of cases mostly selected from journalistic, hospital and private reports. Seventy-two cases of periostitis and associate diseases are very minutely detailed,—the age, sex and temperament of the patient, with the treatment, progressive stages of the disease, and results, being given.

While we cannot recommend this work as a *practical* guide to the dentist, we believe it to be, especially from a scientific standpoint, of considerable merit.

Next comes the memoir of Drs. Legros and Magitot on the "Origin and Formation of the Dental Follicle in the Human and Other Mammalia," also in French.

This memoir is of so important a character, containing, as we believe it does, the latest reliable researches into the early development of the teeth, that although it was written five years ago, we deem it proper to notice it briefly even at this late date.

It commences with the first trace of the dental germs in the human embryo and in the different species of mammals, and illustrates the progressive stages of development of the dental tissues up to the time when calcification commences in the enamel and dentinal pulps; hence it embraces that period in fœtal life commencing near the forty-fifth day and extending to about the seventeenth week,— a period of about twelve weeks.

This treatise is peculiarly valuable because it presents the subject so clearly and minutely that no one can fail to obtain a full and perspicuous view of the dental beginnings, and especially because it embraces that period in dental evolution which is surrounded by the greatest histological and physiological difficulties, which have not hitherto been presented in a clear and satisfactory manner in any language.

We are glad to state that the work has recently been translated into English, with a view to its publication, and that to the translation have been added copious notes, designed to make the subject-matter more easily understood by those not fully conversant with dental histology. Judging from the pages of this translation which we have seen, we believe this work will fill a gap in the literature of our profession which should not have existed at this time.

Dr. Alfred Hill, of London, has published in that city a work entitled "The History of the Reform Movement in Great Britain During the Last Twenty Years." This work is of great value to the student of professional politics, as well as to all who are interested in the growth and causes of advancement of general dentistry. To make any extended review of it, however, would carry this report outside its proper province, hence such will not be attempt-

ed. To speak plainly, the political aspect of professional life is one which, as we believe, has already entered too largely into our professional work and relations, and we should be glad to hear less of discussion on ethical and economical principles, and a more extended and clearer view taken of the real necessities of the profession, as such. It is well to have books, periodicals, societies and colleges; but it is better, having these, to scrutinize, criticise and guide them toward professional excellence, rather than to allow them to drift toward personal aggrandizement.

"Practical Observations on the Degeneracy and Preservation of the Teeth" is the title of a small book intended for popular reading, of which Edwin Cox, L.D.S., of London, is the author. From the scientific and ethical points of view this work ranks very much higher than the ordinary popular dental treatise. In fact, it will be found of great value to the dental practitioner at large, as well as to his patients, and is recommended to such as containing not only many old ideas, which most of us had almost forgotten, but statistical and selected information and ideas new to many professional men. The following extract is from the preface: "True, they (dental diseases) are not infectious, like zymotic maladies, but, like them, they originate in faulty hygienic surroundings and violations of natural law, and their arrest and removal cannot be accomplished to any adequate extent by professional and direct treatment alone, however skillful and thoughtful, but demand the observance of general sanitary laws, the study of dietetic and medical principles, the adoption of preventive and anticipatory treatment, the avoidance of confessedly bad habits and irrational customs,—in short, a return to that course of life which best conduces to the healthy and harmonious development of the physical and mental powers." This is the key-note to the conclusions of the writer in the body of the work. To prove these propositions he amasses a considerable quantity of respectable and valuable evidence.

The writer holds, as the predisposing causes of caries, 1st, Systemic disturbance; 2d, Hereditary defect and predisposition to decay; 3d, Influence of climate and soil, and 4th, The sympathy which everywhere prevails between the dental condition of a nation and its habits and modes of life. This latter proposition he elaborates into seven chapters (Part 2 of the book), starting with

the statement that "Sympathy between the dental condition of a nation and its habits and modes of life may be regarded as a general law more or less visible throughout the history of ancient and modern races, and its most familiar evidence lies in the fact that in proportion as simplicity of tastes and the conditions of health are forsaken, and life becomes artificial, sedentary and intensive, dental disease obtains and extends." In illustration of this fact, he gives two chapters to dietetic errors, and one each to alcoholism, nicotinism, want of cleanliness, and syphilis, summing up his views as follows:

"Dental deterioration results from neglect or violation of the natural laws of health. If it were possible to find a people who for generations had obeyed these laws, among such dental disease would be unknown. The teeth were designed to render a life-long service, and the agony of extraction is the protest, and, in part, the penalty, by which Nature condemns the disobedience involving their removal. In greater or less degree this disobedience is common to all people, and, as a consequence, a proportionate infliction of dental disease. The most familiar forms of such disobedience, and the most potent for evil, are those unwise dietetic and social habits and vices (to which we have referred) producing general physical enfeeblement and depression of vitality, a morbid — that is to say, an acid — state of the blood, and a corresponding acidity of the secretions of the mouth; and in the growing influence of such vices and evil practices, and wrong dietetics, and want of due cleanliness, we find the chief causes of dental degeneracy."

The third and last division of the work contains a chapter on "Habits and Hygiene," in which the writer favors the "fruit and farinaceous" over the "flesh" diet, a chapter on the care of the teeth in childhood, and one on "conservative dentistry" in youth.

We have been thus full in our treatment of this little book because of our conviction that its principles, although in the main tolerably well known, are not heeded as they should be by the mass of professional men. How many of us are there who so far strike at the basis of possibility of a dental profession as to systematically and continuously endeavor to prevent dental disease by systemic hygienic treatment? Who warns his lady-patients of the pernicious effects of the ordinary evils incident to modern female life, as want of exercise, omnivorous diet, late hours? Or his gen-

tleman-patients of the bad effects of intemperance, the use of tobacco, epicureanism, or any dissipation? Many will answer: "Such things come only within the province of the general medical practitioner." Are *we*, then, *less* than medical men? Are we healers of the sick, or are we simply tooth-fillers and replacers? And shall we aim simply to *cure*, leaving *prevention* of disease to others, or to *no* others, as the case may be? A view of dental professionalism which extends no farther than tooth-filling is only a partial one, and if universally held, cannot fail to destroy all attempts at advancing dentistry beyond the position of a mere mechanical art.

The province of materia medica in dentistry is one which, while of great practical and theoretical importance to us, is as yet hardly explored. The application of many remedies, well known in general medicine and surgery, and which, theoretically, would be expected to be of benefit in operative dental practice, has not yet been generally made. It is improper, in this place, to endeavor to trace the causes of this fact, yet the inference from history may be made that increase in the number and change in the character of remedial agents for dental disease will occur in exact ratio with the development of truths in dental pathology. This condition of scientific twilight about dental materia medica is the probable (and most obvious) cause for the scarcity of separate works on the subject, and for their comparatively insignificant character when such do appear. The brochure of Dr. J. W. White, published some years ago, was, until last year, the only work treating exclusively of the subject, so far as we are aware. But now another small work, from the pen of James Stocken, L.D.S., F.R.C.S., of London, is before us. The paucity of works on exclusively dental materia medica, in the language of the preface, "induced the medical staff of the National Dental Hospital to depute the author to compile a manual for the use of the Hospital, and he undertook the task for that particular purpose. Subsequently, however, it was urged upon him to extend its scope with a view to publication." Accordingly, after having appeared in sections in the "Monthly Review of Dental Surgery," it is now issued in the form of a duodecimo volume of one hundred and forty-seven pages.

The work commences with a few pages of definitions and tables, followed by one hundred and four pages on the main subject, and

closes with about twenty pages of formulæ. The arrangement of the matter is excellent, the remedies being placed in alphabetical order, and, in most cases, the old and new chemical formulæ, the characteristics, preparation and physiological effects and therapeutics of each remedy being given. Still the work, to an American practitioner, would seem incomplete in some particulars, and redundant (as materia medica) in others. Certain remedial agents in common use here are either ignored or very slightly treated. Oxalic acid, Monsel's solution, oxide of zinc, have no mention in the book. Creosote is treated by saying, simply, that "carbolic acid has nearly taken the place of this agent, for, though very nearly identical in their action, some advantages are claimed for the carbolic acid." Bleaching appears to be unknown in England, for this process is not mentioned, though the lime and chlorine compounds are otherwise pretty well treated. Oil of cloves is dismissed as a "popular remedy for odontalgia." Precipitated chalk is spoken of as "good for obtunding the sensitiveness of dentine." Permanganate of potash is said, when "applied in powder to a carious tooth," to "cure odontalgia." Many remedies, certainly not in common use by American dentists, are fully discussed, as croton oil, cod-liver oil, and wheat starch (for bandages). Also, it is difficult to discern how such substances as wax, litmus, gun-cotton (*not* the solution in chloroform), India rubber and vulcanite can be considered as materia medica,— at least, directly so. And finally, if gutta-percha (as a temporary filling) and mercury (as a component of amalgam) are to be held as dental materia medica, why should gold, tin and oxychloride of zinc be excluded?

In passing, it may be well to say that, in a recent American dental periodical, this work being under review, the author was reminded that the use of "quotation marks" had been neglected by him. So far as we can see, ample general credit has been given, by name, by the author, to his authorities. Further than this it would be difficult to go; for, in writing anything, should one credit *each item* of his acquired knowledge by such distinction, the vast majority of all literature would consist of "quotations," to the despair of the type-setter and the total abolition of "original" essays.

Turning, now, to periodical literature, we chronicle four new ventures in that field,— one Italian and three American. Of the

first, since we have not seen a copy, we can form no opinion, except such as may grow from the character of some extracts translated into our own journals. These would seem to show that the new journal (called "L'Odontologia") bears an excellent character for scientific literature.

Of the American journals, the first in date of appearance is the rejuvenated "Canada Journal of Dental Science." Long in abeyance, this periodical made its reappearance in August last as a quarterly, under the editorship of Dr. W. Geo. Beers, and is an independent journal, he being its sole proprietor and publisher.

The "St. Louis Dental Quarterly" is also an independent journal, its editors, Drs. C. W. Spalding and Henry S. Chase, being its proprietors as well as its conductors.

For some years past the New York Odontological Society has published its transactions through the medium of the "Dental Cosmos," but various reasons induced changes which have resulted in their quarterly appearance in the pages of the "Dental and Oral Science Magazine," edited by Mr. James E. Dexter and published by Mr. R. S. Williams.

The transactions of the Odontological Society form the main portion of the literary department. To these are added two departments of selected matter, the one from dental, the other from surgical and medical, sources. Other sections contain original contributions, not from the Society's transactions.

In some respects this journal opens up a new field for dental periodical literature. We note the absence from its pages of society, college and other local and general movements in dentistry. No matters not strictly connected with the higher scientific progress of the profession are found recorded in its pages. In fact, the absence of much which (to quote from the prospectus), "possessing merely local or temporary value, makes no mark on the record of professional excellence," forms the basis for the new departure. The intention appears to be to make this journal, as nearly as possible, an exposition of the *science*, *pur et simple*, of American dentistry, leaving other matters (without, however, denying or belittling their professional interest and value) to the various other journals.

Again, although the magazine is published by a dental manufacturer, yet its whole literary portion is under the sole control and

direction of the New York Odontological Society. This will form a bar, in this case, to the charge of manipulation of the reading matter in the interest of the manufacturer,—a charge made against almost all the other dental periodicals,—and is a movement in the direction of independent journalism.

These main features constitute the novelty of the enterprise. Three numbers have appeared, and we may truly say that if the journal is maintained at the standard of excellence already reached, the "Dental and Oral Science Magazine" will, without question, be *facile princeps* in the ranks of American dental journalism.

The general character of the Canada and St. Louis journals is that which is already familiar to us in the older dental periodicals. The possibilities of emancipated editorship, however, are, indeed, somewhat marked in each, and notably so in the Canada journal.

Notwithstanding these steps taken to secure an unbiased medium of professional thought, our general periodical literature comes far short of what we should desire to see it.

Certain faults in the method of conducting the literary department of our periodicals have driven some of the best men of our profession to either keep their ideas and results to themselves, or to express them only through the medium of their local society meetings; and as but few of these latter publish their transactions, and of those which are published the circulation is very limited, our periodical literature, under the present régime, can present only a very partial and unfavorable view of the highest present attainments of dentistry in this country, and your committee see no means of placing the profession justly on record except by the establishment of an absolutely untrammeled journalism.

DISCUSSIONS.

Dr. McQuillen: The report claims that the publishers of our journals, who are interested in the manufacture or sale of dental goods, are influenced by mercenary considerations in the management of their magazines. Now, from my long connection with this department of literature, I know it is utterly impossible to carry on what is called an independent magazine. It is impossible for even the medical profession to do this. Publishing-houses are dependent to a great extent upon the advertisements that

come in as a source of revenue. I say if we are to have a magazine, let it be one that will be a credit to us,— that shall have some character and weight. The Odontological Society claims to publish an independent journal. We are told that, under the condition governing that society, there will be freedom of expression. What is the Odontological Society?— the "creme de la creme" of the profession, the society of societies among dentists,— composed of most estimable, high-toned and honorable men, for whom I have the most profound respect; but a certain number of them come together, looking upon themselves in this light — some of them among the best operators in the world — and what do they do? They allow themselves to be made use of as the mouthpiece for, and I may say the indorsement of, the so-called "new departure!" Is it not so? They may not mean it, but they give these doctrines an indorsement by giving them such great prominence in their columns. My friend Bogue called upon me several years ago and said, "Can't we get up an independent journal? We are bound down by the thralldom of the publishers." "Can we not subscribe money toward having an independent journal?" I said, "If your pockets are deep — if you have plenty of money— if you can pay a man of experience two or three thousand dollars a year, and keep on doing so for ten or twelve years, you may perhaps run an independent journal. If, however, you expect the dental profession is going to do this, you are very much mistaken."

Dr. Atkinson: We are under a heavy cloud of ignorance, and it would require very close and shrewd discrimination for us to say just what had been and what had not been beneficial in the various publications that have appeared in the scientific, medical and dental journals. That there is a difficulty in the way is very manifest. What is that difficulty? We have had no editor, in textbook or journal, that was adequately competent to the fulfillment of that duty. What is the duty of the editor of a journal for distribution in any literary, scientific or professional circle? It evidently is, that he may have such discrimination as to enable him to select suitable matter irrespective of the personality of speakers or writers. I have been pained beyond measure, for three years, in consequence of a leading article in The Dental Journal of the world, and the excuse of the editor, when I was pleading with him to leave it out for the good of the profession, was, that it

was all he had at command. I replied, "You had better have nothing, better have an entire blank, than to have such driveling idiocy that has pained every man of any heart or any brains, for the last three years, in the articles referred to, on "Dental Pathology and Therapeutics."

As to having an independent journal: There is a very great difficulty, and it requires us to know what we mean by an independent journal. There is no such thing as independency. We have to do the best we can under the circumstances, so far as dental literature is concerned. With all the errors that are found in the "Dental Cosmos," I will set it up a hundred to one against anything published in the English language, for usefulness to the dental profession, and for direct terseness and selection of the part worthy to be reported. Many times the pressure has been so great on the publishers of that journal as to compel them to put in the mere verbiage of "Officers," etc., as minutes of the society. Why was it borne with? Just as you bear with the irregularities of infants in your arms. Now we have come to a position where it is not worth while for us to do so any more.

REPORT

ON

OPERATIVE DENTISTRY.

By MARSHALL H. WEBB, of the Committee.

OPERATIVE Dentistry includes within its range the application of remedial agents for the correction of perverted function and removal of abnormal growths, that the physiological energies may be free to normally produce and maintain the elements of the tissues and organs; the observance of dentition throughout its different phases, that irregularity of the teeth may be averted, modified or corrected, and the performance of such operations as shall prevent or arrest disintegration or caries.

The deciduous teeth should be retained till displaced by the advancing permanent ones, but it is sometimes necessary to remove disintegrated tissue and fill the cavities in them, that they may be thus preserved. These deciduous organs should be extracted when devitalization of the pulp occurs, and particularly when abscess has taken place, for the reason that solution and absorption of the tissues of the roots of these teeth (as the permanent advance and press upon them) does not normally take place after the death of the pulp, and such absorption is necessary that malposition of the permanent teeth may be prevented.

As the deciduous teeth are dislodged and the permanent ones erupted, an examination should frequently be made, not only for the purpose of averting irregularity of the organs, but to ascertain whether disintegration has commenced upon the proximate surfaces of any of the teeth, or in the fissures of bicuspids and molars.

Disintegration of enamel may be prevented by occasionally polishing the proximal surfaces of the teeth, and having the patient pass floss-silk between them daily. This will not require more

attention on the part of the operator and patient than where so-called permanent separations have been made.

When disintegration has commenced near the part of one tooth that is in contact with another, and after the teeth have been separated by pressure, so that needless cutting of enamel may be avoided, the superficial layer of disintegrated enamel prisms should be removed (after the rubber-dam has been applied) by the use of fine files, and strips cut from emery-cloth or paper of the finer grades, such as No. ½ and No. o. If, after this superficial layer has been removed, the whole surface presents the appearance of normal tissue, it should be carefully polished with pulverized pumice applied upon linen tape or a soft rubber disk. If there remains a portion of enamel of a different shade than that which surrounds it, all the disintegration has not been removed, and it may extend to the dentine, thus necessitating the cutting out of all the disintegrated tissue and the thorough preparation and careful filling of the cavity presented.

"Permanent separations" ought not to be made because they interfere with mastication, annoy the patient, and, with few exceptions, do not prevent disintegration upon or about the surfaces that have been cut. Food wedges at the part where the teeth again come in contact (which they almost invariably do, excepting where antagonists prevent them); this food becomes putrescent, disintegration takes place, and that, too, in a part of the tooth where it is difficult to perform a first-class operation. All this may not take place, however, until the tactile corpuscles throughout the gum-tissue pressed upon have become paralyzed, and the patient is not notified of the presence of impacted food.

As it is better to use tin, oxy-chlo. zinc, gutta-percha or amalgam than to improperly or imperfectly insert gold, so also is it better to cut away a part and endeavor to save what remains of a tooth than to deprive the patient of the organ altogether; but operators ought to have a higher appreciation of fine and beautiful tissue than to content themselves with simply being capable of using an alloy, even if they can properly prepare the cavity of decay, insert the material and finish it, or to insert gold and then cut away enamel so as to conform to such filling, and to make permanent separations, and thus mar the beauty and at least partially destroy the usefulness of priceless organs.

When disintegration has advanced along a fissure or in a sulcus, or the sulci of a bicuspid or molar tooth, the rubber-dam should be neatly applied to the tooth in which such a cavity is found, as well as to the one or more adjoining, so that the parts may be made dry and brought more plainly to view. If decay has made considerable progress beneath, and the opaque carious dentine can be seen through the plate of translucent enamel, the cavity should be opened into by means of enamel-chisels. The softer portions of carious dentine should then be removed by sharp excavators, the fissures sufficiently opened, and anchorage for the filling made by keen burs operated with a "dental engine." The walls should be well shaped, with very little undercut; the margins of enamel evenly and smoothly finished with fine, sharp plug-finishing burs (so-called); a starting-point made (if one of the fissures does not serve the same purpose), and the whole cavity so prepared that all the gold may be impacted by aid of the mallet.

It is necessary to apply the rubber-dam to obtain desirable results in the class of cases just referred to, and no permanent operation should be performed where decay attacks the buccal and labial surfaces, unless this most valuable of all the aids be properly applied. This can and should be done in all cases, provided the operator has the ability to successfully use the same; and although pressure upon the gum is necessary that the rubber-dam may be carried to the necks of the teeth, to be operated upon, yet, when properly applied, and ligatures of waxed floss-silk are used, inflammation of the tissue pressed upon will not take place, excepting, perhaps, in rare instances, when it will soon subside. That operations be performed as well as possible, it is necessary that the parts be kept free not only from saliva by the use of the rubber-dam, but also from all moisture; even the vapor contained in the exhalations from the lungs, as well as the touch of a finger, will prevent the cohesion of gold, which cohesion is essential to success in the performance of all, and particularly the higher type of operations.

Whether the material to be used for a permanent filling be gold or tin, a half-leaf of light foil for small, a whole leaf for medium, and two leaves for large operations should be taken from the place in the book in which it comes by means of a spatula or the foil-carriers, and placed upon a piece of spunk, which has been cov-

ered with white kid. This foil should be folded with an ivory spatula into a tape-like form of about four, eight or ten lines in width, respectively, then taken up in the foil-carriers and cut across into parts about a line wide. As these parts are cut from the ribbon, they should fall upon spunk, covered with kid, from which they can be readily taken with small-pointed foil-carriers or the packing instrument. Heavy foils (such as Nos. 30 and 60) may be used to great advantage, especially in the restoration of the contour of missing tissue, although light foil, when prepared as just described, can be more easily impacted into small cavities, fissures and grooves.

Any preparation of gold can be made more uniform in density, with greater ease and rapidity, by the aid of a properly adjusted electro-magnetic mallet, operated by a full current of electricity and guided intelligently, than by any other known method.

As each piece of properly prepared foil is passed over the flame of alcohol and introduced into the cavity (either by an assistant with light-pointed foil carriers, or by the operator himself with the packing instrument), and simply attached to the part (one or two pieces) placed by hand in the starting-point or that already there, the electro-magnetic mallet should be set in operation, and the finely-serrated point of the packing instrument placed *(not pressed)* against and made to operate upon the gold in a manner somewhat similar to that of making dots on paper with a pencil. Light, hard, or graduated blows can be made without changing the adjustments of the instrument, as fine or heavy lines are made on paper with a pen. When the electro-magnetic mallet is operated and guided as here indicated, gold can be carried against and over the margins (even frail edges) of enamel without fracturing them, and without the instrument passing off and puncturing the rubber-dam and wounding tissue. Almost the same blow is required throughout each and every operation, because the gold should be solid and uniform in density; hence the action of the battery ought always to be regular, so far as intensity and constancy are concerned, and the pieces of gold for a given operation should be about the same in size and in degree of cohesiveness, and be uniformly and solidly impacted.

All gold should be cohesive, especially when a mallet is used, so that each piece may remain just where it is placed, and also

that the filling may always be one and inseparable. If there be no affinity between particles, a thoroughly useful, beautiful and permanent operation cannot well be performed; neither can the precious cohesive particles "exhibit enduring strength," unless each body of particles or piece of gold be carefully, thoroughly and perfectly impacted.

If in impacting gold any part or the whole becomes displaced, it ought to be removed at once, otherwise the filling would be imperfect. Gold in the form of pellets and cylinders and in a non-cohesive condition may be used in some so-called simple cases; but when really fine or first-class operations are to be performed, foil ought to be so carefully prepared, introduced and impacted that the operator can be positive that each piece has been firmly anchored, attached, or has adhered to that already in position, and being certain of this, the filling may be made solid and uniform in density, and the organ operated upon fully restored to usefulness.

When caries takes place in the labial portion of an incisor or cuspid and buccal surface of a bicuspid or molar tooth, and the cavity extends beneath the margin of the gum (as also with some cavities within proximal surfaces), it is sometimes difficult to apply the rubber-dam; but then a ligature of waxed floss-silk should be placed twice around the tooth which is to be operated upon, after it is secured to the adjoining tooth or teeth, and while holding the ends of the ligature in the left hand, and just before tying the last knot which is to tighten such ligature, both it and the rubber-dam should be pressed above the margin of the cavity, so as to bring it into view and secure dryness. In such cases it is often necessary to hold the ligature, together with the rubber-dam, above the margin of the gum by means of a broad-pointed excavator; but before commencing such an operation, it is best to have everything at hand that may be required. A clamp should be used when the rubber-dam is to be applied to the lower, and at times upper, molar teeth. The clamp should be first adjusted to the tooth, and the rubber-dam then stretched over it from the posterior to the anterior part, and be also applied to the adjoining tooth or teeth.

After the removal of carious dentine with sharp excavators, the margins of such cavities should be evenly and smoothly finished, and all disintegrated enamel removed by means of fine, sharp burs. A slight undercut should be made around the cavity along the line

where the enamel and dentine coalesce, and a starting-point be drilled in a direction where there is no liability of the drill going in too close proximity to pulp-tissue. The first piece of foil should be placed in such starting-point, and after that has been inserted, all the gold ought to be impacted with the mallet. When the cavity is entirely filled, the gold should be trimmed down to conform to, and be even with, the surrounding surface of enamel by means of sharp chisels and files or fine burs. All this should be done previous to the removal of the rubber-dam, after which the gold and surrounding enamel ought to be finely finished with pulverized pumice, applied upon wood, leather or rubber points.

Disintegration upon the approximal surfaces of the teeth commences, almost invariably, just above the part in contact in the upper and just below it in the lower teeth, and when the dentine is reached, caries advances beneath the enamel in all directions. When this takes place upon the proximate surfaces of the incisor and cuspid teeth, they should be separated by the wedging of wood, or pressing of linen tape or cotton between them. After sufficient space has been made, white gutta-percha should be placed in the cavity and between the teeth, and remain a day or two, till the irritation incited by the wedging has passed away. Rubber ought never to be used for the purpose of separating teeth, because of the irritation which it induces. Quick wedging is frequently necessary, and it is often best to place a wedge of orange wood between the teeth, even after having pressed them apart, not only to gain more space, but to stay the tendency to approximation, and to make the organs more steady during the performance of the operation or operations, especially if the irritation from the previous wedging has not passed away sufficiently to admit of the insertion of all, or almost all, the gold by aid of the mallet. When the required space has thus been gained, the rubber-dam should be applied, the quick wedging resorted to if found necessary, and the operation commenced. The cavity should be carefully prepared, the edges of enamel smoothly and uniformly finished, a groove or undercut made toward the cutting edge and at the cervical wall (so-called), and a starting-point drilled along such wall toward the palatal edge; all such anchorage should be made in the dentine, just inside the line of enamel where these two tissues coalesce. In the filling of these cavities, particularly the

small ones, more than those in any other location, it is necessary to use what is known as "hand pressure," and pack some of the gold (into undercuts) with small curved instruments, having fine and sharp serrations. Cohesive gold can be very successfully used in these cases also; but only when prepared from a half sheet of light foil, such as No. 4, and so folded as to be equivalent to No. 16, and then cut into strips about a half line wide. In many of the class of cavities here referred to, as well as in most others, all the gold can best be impacted with the quick and decided blow given by the short stroke of the electro-magnetic mallet. The whole operation of inserting the gold should be performed as before indicated, and be so completed that there shall be a perfect restoration of the contour of the missing tissue.

After the preparation of such cavities as just referred to, particularly the larger ones, and previous to the insertion of the gold, the margin of enamel should be smoothly finished with, but not rounded by, emery-cloth, first with a strip cut from No. ½, and then one from No. o. When the gold has been impacted, and its surface trimmed down to the edge of the enamel which surrounds it, and the whole made to conform to the contour of the tissue which the gold is to substitute, by means of a No. 1 or No. o Froid-file upon the proximal surface and labial edge, and a fine bur upon the palatal portion, strips of fine emery cloth should be so manipulated as to perfectly finish the surface of the gold, and to leave the parts smoothly and beautifully formed. All this had best be done previous to the removal of the rubber-dam, after which the filling should be completed by the use of finely pulverized pumice and then silex, each mounted and applied upon fine linen tape. Rouge may be then applied upon a strip of fine chamois skin. Fine pumice, silex and rouge leave a finer finish than, but not so bright a lustre as, a burnisher, which instrument ought not to be used.

All operations ought to be performed as perfectly and artistically as possible, so that if gold is exposed to view, it shall not be repulsive to sight. The gold should be so impacted against the dentine and enamel that, when the operation shall have been completed, and the surface of enamel made clear and bright again, the gold tint may be seen through the light walls or edges of the translucent enamel, thus evincing that the filling was perfectly inserted.

When, through disintegration, the enamel of a proximal surface of a bicuspid or molar tooth is penetrated, and the dentine is involved in the disintegrative process, separation by pressure is here, also, necessary. While sufficient space may be gained between the incisor teeth by what is known as "rapid wedging," yet such wedging of bicuspids and molars cannot be so easily and rapidly accomplished, and especially when the cavity extends almost to the margin of cementum; although in such case the gold can be built into and from the starting-point, and along the "cervical wall" and to the part to where the convex portion of the filling should be carried, and, after this much of the gold has been impacted and smoothly finished, a wedge of wood may then be inserted between such gold and the tooth adjoining, and sufficient space thus secured to enable the operator to so complete the operation that there shall be no space between the teeth excepting at and near the necks. If the operator cannot do this, then a wedge of boxwood may be placed from the neck to a part about midway between it and the masticating surface of the tooth, and cut away with burs to the shape the filling should be, but such an appliance should not be depended upon to retain any portion of the filling. Separation by pressure must be made in some way, else gold cannot be built out and finished so that the teeth may again closely approximate and prevent the wedging of food between them, excepting, perhaps, in the case of a youthful person, when the space left from the finishing of the fillings by fine files and emery cloth may again close. Undue and long-continued pressure of the parts upon the capillaries held within the connective tissue, which covers the cementum, may prevent the return to normal and free circulation within such vessels after the wedge has been removed, but this result may follow only when proper care has not been taken, or the wedge too rudely or violently applied.

After sufficient space has been gained in the manner described, the rubber-dam should be applied to the two teeth that have been separated by pressure, and to the tooth adjoining each, that the teeth separated may not approximate, to some extent, during the performance of the operation or operations, and the organs can be operated upon with greater facility. Excepting in rare instances, a cavity within the proximal surface of a bicuspid or molar should

be opened into from the masticating surface, because, even where but little tissue appears to be involved in the disintegrative process, this surface would be almost reached upon the perfect removal of the disintegration, and the plate of enamel would be liable to fracture if hard substances were to come in contact with it while food is being comminuted. It is far better to cut away the enamel between the cavity and masticating surface than to sacrifice tissue along the entire proximal wall; besides, a better view can be thus obtained, and the whole operation more perfectly performed. In addition to this, the adjoining fissure or sulcus usually requires attention, and should be prepared and filled in connection with, and at the time of, the performance of the operation within the proximal wall. Each and every cavity ought to be so prepared that no disintegrated tissue remains; the margins should be evenly and smoothly finished with fine burs, files and emery cloth (the edges may be beveled in some cases, but not rounded), and a groove be cut along each wall of the cavity. This groove should not be more than a thirty-second, and rarely but a sixty-fourth of an inch in depth, and should be made in the dentine just within and near the line of both the buccal and palatal or lingual portions of enamel, and to extend from the masticating surface to the cervical wall, along which a groove should not be cut because of there not being sufficient depth of tissue to make it safe to remove any of it for such a purpose. Where function has been interrupted and the tissues have not been perfected (as well as in some other cases), the enamel and dentine remaining between and a little above the normal edge of the gum and margin of the cavity (if decay has not advanced to this part) should be cut away with fine burs. Such preparation should be made to about (or a little more than) half a line beyond the margin of the gum, because chemical action takes place at the surface of liquids, and as the surface of saliva is usually at about the same line with the gum, disintegration may take place at such part (even though the whole operation shall have been otherwise thoroughly and well performed) unless tissue be removed and the gold (or any other material) properly inserted and its surface finely finished beyond and about the line just referred to. When the gum is in normal condition it embraces and so perfectly protects the portion of enamel (and well inserted and finely finished gold) which may be

beneath its margin, that disintegration, and even discoloration, is prevented.

In deep, or relatively deep, cavities, carbolic acid should be applied to the dentine, not only to serve as a disinfectant, but that the protoplasm of the ends of the protoplasmic strings (in the tubuli and crossing the intertubular tissue and also found between the enamel prisms) may be coagulated, and sensation be thus partially obtunded.

In cases where thermal changes may produce more than the usual shock in healthy tissue after the operation has been performed,— oxychloride of zinc, "cement plombe," or "agate cement"— should be placed in the bottom of the cavity as a non-conductor of thermal currents in the protoplasmic strings.

When a cavity within the proximal wall of enamel of a bicuspid or molar tooth has been prepared as described, a starting-point should be made along the cervical wall, and at that point in the dentine which shall be the safest along the line of its coalescence with the other hard tissue of the part, the enamel or cementum. This point, in which to start the filling, should not be deep, yet sufficiently so to retain the small pieces of gold first introduced and impacted until other pieces are built upon them, and so far as, and along to, the groove in each wall,— the buccal and palatal or lingual. The gold ought to be built against every part of the dentine, impacted as nearly perfect as possible along the enamel and a little beyond its margins, and fully carried out to the line that defined the contour of the missing tissue. To thus fully perform such an operation it is necessary to build the gold (or rather that part of it nearest the buccal and masticating surfaces) against the proximal surface of the adjoining tooth. By performing this operation with a properly adjusted electro-magnetic mallet, the passing of the packing instrument from off the edge against or over which the gold is being impacted, may not only be avoided, but the surplus material can be so trimmed away during the performance of the operation that comparatively little is afterward necessary to make the part restored conform to the original type. In these cases (as well as others) the gold ought to be cohesive and be prepared and manipulated as hereinbefore described. Cohesive gold-foil, properly prepared, can and should be used in the performance of all operations, and all be impacted by aid of the

mallet when it is properly operated, and especially in the cases just referred to, and those where frail edges of enamel are to be supported and protected.

When the gold has been so impacted, piece by piece, that the substitution for lost tissue is complete, a fine saw, file, or some such suitable instrument, should be used to cut away the surplus gold, and to aid in making the filling conform to the original contour of the part; after which narrow strips cut from fine emery-cloth should be so manipulated as to perfectly finish the surface and leave it properly formed. When this has been done, and the rubber-dam removed, the finishing should be completed by the use of fine pumice and silex upon linen tape, as before suggested. The gold at the masticating surface should be finished with fine burs, and, by their aid, made concave or to conform to the original type of the part operated upon. The gold should be so impacted as to be flush with the prepared margins of enamel, yet, even then, made concave where such concavity is indicated. Fine burs should be used for the purpose of trimming and shaping such fillings, because the form of the remaining part or parts of the cusps and prepared edges of enamel against which the gold is impacted may be changed and the teeth made less useful where corrundum points are used. The polishing of the gold upon the surface referred to may be done with pumice and silex, mounted on wood, leather or rubber points.

Whether a cavity be large or small, the gold ought to be built out to the original contour, and, at its periphery, a very little beyond the margin of enamel, then finished down to the surface of such enamel, and the whole filling made to conform to the line that defined the contour of the lost tissue; contour signifying "the line that bounds, defines, or terminates a figure." This line ought to be restored to that degree commensurate with the extent of destruction of tissue. If the gold be not impacted against, and be not flush with the edges of enamel, the operation is not such as is demanded for the preservation of remaining tissue. A plain surface of gold should not be made, because the enamel of the tooth thus operated upon may approximate closely that of the other, and disintegration may take place upon the surface of the enamel near or at the part in contact. Restoration of contour prevents such contact, and this prevention is necessary, especially where the tissues of the organ operated upon are not fully calcified. The con-

tour of missing tissue ought always to be so restored with gold that the enamel of one organ may be free from contact with that of the next in the arch, and also that a part of the gold in the one may approximate and be certain to rest firmly against the normal tissue of, or a filling (if one has been inserted) in, the adjoining tooth, when disintegration is not likely to take place, because of the freedom from proximity and the cleansing (by the saliva) of the margins of enamel against which the gold has been placed and finely finished.

When operations have been so performed as to entirely prevent fluids or semi-solids from entering between the material and the tissue against which it has been placed, the gold-tint may be seen through the light walls or edges of translucent enamel, immediately upon or soon after the removal of the rubber-dam and completion of the operation. If an opaque or dark line, or spot, be visible at or near the parts where gold ought to be in contact with dentine and enamel, the operation has been imperfectly performed, and chemical action may soon follow and the entire filling prove a failure. The cause of such failure might be attributed to in-"compatibility" of gold with dental tissue, but this would be a departure from the truth. If operators were always very thorough in their work there would be no occasion to refer the cause of these failures in dental operations to chemical action.

When operations have been performed in the manner herein described, and all the fillings as carefully and skillfully inserted and finely finished as suggested, they are the best for the preservation of remaining tissue, protection of the enamel over which the gold has been placed, and for the prevention of the wedging of food against and the consequent recession of the gum; they subserve well the purpose of mastication, and present a beautiful appearance.

Even when a case presents where the tissues are diseased and decay is extensive, and with here and there a crownless root, such a case should be properly treated; all operations that may be required ought to be performed as perfectly as possible, and artificial crowns placed upon the roots, (especially those in the anterior part of the mouth,) in accordance with some one of the best methods that have been described,— from that of the plain porcelain crown fastened to the root with fine, well-seasoned

hickory wood, and all interstices between the crown, wood and tissue closed by white gutta-percha that can be nicely manipulated, to the building of a gold crown with a porcelain face. Even where a root is missing, such a porcelain face with gold attachments can be successfully built into the two adjoining teeth. Both these last mentioned operations were described and illustrated by the writer in the *Dental Cosmos*, June, 1873.

VOLUNTEER PAPER ON OPERATIVE DENTISTRY.

By GEO. J. FRIEDRICHS.

QUERY: Is the keeping of cavities dry an absolute necessity in the filling of teeth, in order to preserve them?

From the time I commenced the study of dentistry, thirty years ago, there has been a tacit admission on the part of the members of the profession at large, and it has been openly taught by the authorities in our dental colleges, that it was absolutely necessary to keep cavities dry during the operation of filling; and to substantiate the truthfulness of my assertion, I shall quote from the writings of prominent members of the profession on this subject. Prof. Stellwagen says in Vol. xi, No. 12, Dental Cosmos, page 621: "To-day the profession is most united in urging upon the young the constant employment of saliva-pumps, napkins, dams, etc., as essential for the attainment of the highest degree of perfection in their operations."

Dr. Chase, Vol. 1 Missouri Dental Journal, No. 7, page 252, says: "We must all come up to the standard of dry cavities; its importance is the very ground-work of all good plugging; there can be no good plugs made without they remain perfectly dry until the gold is all packed."

Dr. Cushing, in a paper read before the Illinois State Dental Society, on "Filling Teeth," Missouri Dental Journal, Vol. 1, No. 7, page 300, says: "The next important thing to be observed, preparatory to filling, is the securing the absolute dryness of the cavity, however that end may be attained."

The above quotations are certainly all-sufficient to show the teachings of the profession on this point.

What inference, then, are we to draw from the above assertions? It is positively stated that no good fillings can be inserted unless the cavity is kept perfectly dry. Now, fillings are evidently put into teeth to serve a certain purpose other than ornamental; it then follows, reasoning *a priori*, that unless the cavity is kept perfectly dry failures must ensue, but "facts are stubborn things."

I have kept a record of cases where I was unable to keep the cavity dry to the end of the operation, and I find, after a period of ten years, that they bear the test of time as well as others that I filled in the same mouth, in which I succeeded in excluding moisture.

My first case on record was a little girl, aged nine, whose first molars, both the superior and inferior, required filling. I succeeded in keeping the cavities dry to the end of the operation in the two superior molars, but in trying to fill the inferior I found it a matter of impossibility to do so. These two teeth I filled under protest — that is, I informed the mother that I was not responsible for the results that might follow, as I did not believe that the fillings would last two years; and, furthermore, if she knew of an operator in the city who could fill them properly that it was her duty to have him refill them. This advice was not acted upon, but the little girl was brought to me every six months to have those teeth examined.

I have filled for her since many more teeth, and, to all appearance, those two which were filled over ten years ago, and under the circumstances above stated, are in as good a state of preservation to-day as the rest of her teeth that were filled, and where moisture was excluded to the end of the operation.

I could give many other cases in which the results were the same. I will add that all the cases in which I was unable to keep the cavities dry to the end of the operation were in the teeth of the inferior maxilla, and in the mouths of children.

Keeping in view our object, the next question that arises is, What constitutes a good filling? In my opinion the following points must be attained before we can have any expectation of success in the preservation of the teeth:

First. The material employed must be, to all intents and purposes, indestructible in the oral cavity.

Second. The material employed must be packed solid, so as to render it impermeable, and secured in such a manner that it will require force to dislodge it.

Third. It must be left flush with the orifice of the cavity, and finished in such a manner that it can be kept clean.

Therefore, whenever the above conditions are obtained, it is self-evident the filling must be good, whether it is put in dry or wet.

It may be, that with cohesive foil, or crystal gold, the above-mentioned conditions cannot be fulfilled unless the cavity is kept perfectly dry; but does this prove that it cannot be accomplished with non-cohesive foil in the shape of cylinders?

I contend that such a thing as an absolutely dry cavity in a tooth, while in the mouth, is unattainable, and can only be so relatively.

The science of physics teaches us that no two substances can at one and the same time occupy the same space. Therefore it follows, that when a cavity in a tooth is filled with gold, this space occupied by the gold cannot be occupied by something else.

And in conclusion, when cohesive foil or crystal gold is used, there is an absolute necessity to keep the cavity dry, and the gold from becoming moist during the operation. Unless this condition is obtained, a solid and impermeable plug cannot be made with these two forms of gold.

And unless a filling perfectly excludes, and is impermeable to, extraneous substances, no hope can be entertained of its aiding in the preservation of a tooth from future decay. For a filling in a tooth is not a restoration of the parts lost through decay, but merely a patching up; and in doing this, the dentist performs no radical cure, for he does not remove the original cause, which still remains present after the operation is completed.

VOLUNTEER PAPER ON OPERATIVE DENTISTRY.

By D. D. SMITH.

WHO has not mentally asked the question, as he has taxed himself and his patient to almost complete exhaustion in some dental operation of unusual magnitude or length, is there not some way either to prevent this destruction of tissue or to restore these organs when attacked, unattended by the severe mental and physical strain upon the operator, and the shrinking, dread, and suffering to the patient which the present general practice and teaching involves?

Is the popular impression true that generation after generation the teeth of civilization are degenerating, and their power of resisting decay lessening? and shall dentistry still persist in averting the evil by the use of one remedy, mechanically applied, in all cases and in all conditions?

Is there no consolation other than this that the profession can offer to the tens of thousands who have never shared its blessings, and to many others suffering abuse from burring-engines, dental mallets, rubber-dams, and other appliances, who are in doubt if it confers a blessing or a curse?

Has not the present aspect of dentistry a near parallel in the practice of general medicine of a few years ago, when calomel was of almost universal application? Every age, temperament, and condition felt its power for good or evil. Whatever the trouble, cerebral, thoracic, or abdominal, local or general, calomel as a remedy had its advocates. A generous and earnest spirit in medical science, aiming to relieve suffering and prolong human life, searching for cause and observing effect, broke the bonds of established usage and teaching; tried other means and remedies, until now, with the truly educated, mercury in any and all its forms is but an adjunct in general practice.

Medicine is not so narrow as to withhold its hands from remedies of merit, because, forsooth, they are not hoary with age and use.

Do not the broken arches and the edentulous mouths, continu-

ally presenting, plainly testify that dentistry as now taught and practiced is unable to cope with the diseased conditions of human teeth?

If the profession would avert this evil, observation must be more extended and accurate; new remedies must be sought and applied; investigation by experiment made popular, and the employment of other than mere mechanical remedies encouraged.

The deductions from the teaching of all our text-books, from periodicals and society discussions, point to the use of one filling material only in a given cavity — and that efficient in proportion as it is mechanically manipulated — for the treatment of all carious conditions and for the restoration of teeth.

If gold is recommended, the inference, if not the positive teaching, is that the filling, to be honestly and efficiently made, must be *all* of gold; if tin is the material, the cavity must be filled entirely with tin; and so also of amalgams, gutta-percha, and oxychloride of zinc. The exception to this is in some more recent and advanced teachings on the use of gutta-percha, tin, lacto-phosphate and the oxychloride cements as coverings for exposed pulps, and different materials for use in roots, whatever may be adopted to complete the filling. It is not too much to say that any consideration or discussion of other filling materials than gold, of their composition or methods of use, of their behavior in varied conditions of the oral cavity or of their distinctive properties, has been evaded or frowned upon as too elementary and unimportant to engage the attention of writers or speakers. The desire to be known only as a "first-class operator" has held timid ones chained almost exclusively to the mechanical use of one material, and caused the loss to dental science of many an otherwise earnest investigator.

To inquire if some two or more of the present filling materials cannot be conjointly used in the same cavity for better preservation and greater comfort to the tooth; also to inquire if there may not be some hitherto unsuspected therapeutic action in dental oxychloride of zinc preparations, are the special objects of this paper.

That fillings fail because of lack of adaptation to the walls of cavities is a fact generally believed and admitted, and that gold is the most difficult material to *perfectly* adapt in many cases is also known and admitted. That the oxychloride of zinc cements are among the best, if not *the best*, preservatives in cavities of decay is

a truth which will become as fully admitted when it is as well understood. If decay has ever been known to commence anew under an oxychloride of zinc filling when in place, the attention of the writer has never been called to the fact.

Chloride of zinc locally applied is recognized as among the most efficient agents known for promoting healthy granulations, as "in addition to its escharotic properties it appears to exercise a greater influence over the vital action of neighboring parts" than most other caustics, the separation of its eschar leaving healthy and vigorous granulations. It is equally efficient as an antiseptic and a disinfectant. As an application to chronically inflamed and suppurating gums at the festooned margins, after the removal of tartar, it probably has no equal. This liquid meeting so fully the indications for an antiseptic, and for a stimulant to the production of healthy tissue in a cavity of decay — mixed with the various preparations of oxide of zinc, forms a close and seemingly impervious union with the walls of cavities.

There are good reasons for the belief that these cements when properly manipulated not only exclude moisture, but that they do for diseased dental tissue what chloride of zinc does for more vascular tissue, viz., *stimulate the production of healthy structure* in the parts with which they are brought in immediate contact and in the near surroundings.

Illustration: Ten years ago a cavity of decay was filled on the mesial face of a left superior sixth-year molar with oxychloride of zinc and gold. The decay was deep-seated and involved the whole mesial face of the tooth. A portion of softened dentine was left covering the almost exposed pulp, and the oxychloride placed directly upon it. Enough of this cement was cut away to allow for the introduction of a gold filling, to protect the walls of the cavity and the oxychloride. The tooth was of a character to decay readily and rapidly, but the only object had in view in filling the cavity in the manner described was the better protection of the pulp, by interposing a non-conductor between it and the gold. Something more than six years after, it was deemed advisable to remove this filling for the purpose of gaining access to a small cavity in the distal face of the second bicuspid, which had been forced backward by occlusion until it rested in the concavity of the finished surface of the gold-filling. The conditions were such

that the removal of this filling permitted access to the cavity in the bicuspid without cutting or wedging, hence the adoption of the plan. Other fillings made entirely of gold and introduced about the same time in other teeth in this mouth had failed, and had been replaced in the meantime.

The dentine under the gold and oxychloride in question had undergone a decided transformation, changing from soft to hard and dense structure, seemingly capable of resisting decay without further protection. This exhibition of the beneficial action (as it seemed) of the oxychloride of zinc made a profound impression; and as its cautious use in all classes of cavities from that time to the present has given correspondingly good results, the most favorable conclusions have been formed for the practice of *lining* all cavities with an oxychloride cement, whatever the external filling is to be.

In many cases time can be saved in filling, the certainty of the operation increased, and the tooth rendered more comfortable to the patient; and further, thousands of pulps which under the all-gold system must be sacrificed or capped but to die under the filling, can by this method be comfortably and permanently saved.

The antiseptic and stimulating action of the chloride of zinc is of a most beneficial character, inducing in many cases better organization of the tissues in the living parts to which it is applied.

The manipulations in their simplest form consist in excavating a given cavity in the usual way and then filling entirely with some one of the best oxychloride of zinc cements,—under the rubber-dam if practicable. Having been allowed to set and harden for a few minutes, enough of the cement is cut away or excavated to form a cavity for securely introducing a gold-surface filling. By this means the cavity can be nearly filled, or merely lined with the cement, and *it* kept from disintegration by a filling of gold. The color of the tooth is thus preserved, the pulp isolated from thermal shocks, and the preservation of the tooth more certainly secured.

In ordinary crown cavities, and in many cases of deep-seated caries in approximate cavities, this manner of procedure simplifies and shortens the operation of filling, but in small or shallow cavities complicates it. The cavity may be of such a nature as to render the conjunction impracticable. When such cases occur, the cavity can be filled entirely with gold, tin, or any other filling

material in the usual way. In deep-seated crown and other cavities where under-cuts exist, if the enamel is strong it need not be cut away, for when the decay is removed and the cement carefully and securely packed in its place, it forms a support when hard equivalent to true dentine. A cavity cut in it to a depth a little greater than the thickness of the enamel reduces the final filling with gold to an operation of the simplest character, as this new cavity has a hard, firm base of cement, and a boundary of cement and tooth-material, or of the latter alone.

It may well be inquired if there are not some objections to the use of the oxychloride cements in the manner proposed. There is one objection, and it is believed to be the only one worthy of mention: it causes pain in the tooth immediately on application, varying in degree and duration with the extent of the decay and the character of the tooth. The sharpest and most prolonged pain is usually experienced in young or soft teeth, and its duration is from three to fifteen, and rarely to thirty or even sixty minutes. The pain is greatly lessened or entirely obviated by dextrous and intelligent manipulation, which will follow a study of its peculiarities and its continued use.* Its extensive application for the past two years in all classes of teeth and cavities, as a covering for recently exposed pulps and in hyperesthetic conditions of the dentine, has failed to develop an uncontrollable or even a markedly obstinate case of odontalgia.

Exposed pulps may be first protected with lacto-phosphate and a Weston cap, with an oxide of zinc *pad*, with gutta-percha, or in any manner which seems most desirable, and the cement placed over the capping used. The oxide of zinc pad is made by mixing the powder of any oxychloride cement with creasote or oil of cloves, using but a very small quantity of either liquid. By patting this mixture with a spatula it can be worked into a mass aptly termed a *pad*. This can be used as a covering applied directly to the pulp, or to prevent pain in deep-seated caries. It is unquestionable that the therapeutic action of the oxychloride is much diminished, if not completely arrested, by a covering of gutta-

* It has been urged that the chemical combination which is the result of bringing together oxide and chloride of zinc destroys the therapeutic effect of the latter, but the fallacy of such reasoning is shown by the facts here stated; and further, an application of oxychloride of zinc carelessly or injudiciously made produces pain undistinguishable in character from that of an application of chloride of zinc in the same place.

percha over the pulp, while the oxide of zinc pad modifies but does not prevent its action, and for this reason it is esteemed, and has proved in practice, a better and safer capping for pulps than gutta-percha.

That the action of the chloride of zinc is not wholly interrupted by the *pad* is evident in the fact that the powder of which the pad is made becomes in a short time consolidated and almost homogeneous with the oxychloride of zinc used to cover it.

To recapitulate, we find the advantages of the oxychlorides, as linings or as basal fillings, to consist in the saving of time; perfect apposition of filling material with the walls of cavities; solid base and actual support to frail walls; secure anchorage for metallic fillings; ready adaptation in places difficult or impossible of access with gold; no discoloration of the material itself, and a preventive of discoloration in dentine; comfort, especially to highly-organized teeth; a stimulant to the production of healthy tissue, and the most effectual preservative known in dentistry.

REPORT OF COMMITTEE

ON

DENTAL CHEMISTRY.

By L. G. NOEL, of the Committee.

IN the early days of medicine, physicians who proposed to cure diseases upon strictly chemical principles were treated with scorn and derision by those who held to the mystical teachings of the empyrics, and the followers of Silvius de la Boe, who was in the zenith of his career the leader of the chemical school, were dubbed with the opprobrious cognomen of "chemichers." Notwithstanding the gloom which surrounds the subject of organic life is so dense as to be impenetrable, even to the glare which chemical science in the nineteenth century has thrown upon the field of medicine, we take the ground that these subtleties will yield only to the onslaughts of chemistry. We willingly place ourselves in a position to have the term "chemicher" leveled at us. The teachings of Van Helmont, Silvius and Des Cartes, though crude, and calling forth the sneers and scorn of their contemporaries, were, nevertheless, vitalized by a soul of truth, whose immortal energy is still living, while they rest from their labors.

The etiology of caries of the teeth has been one of the most subtle questions with which pathologists have had to deal; and while your committee cannot promise a chemical analysis, or synthetical exegesis of the subject, we do propose to call attention to some of the explanations which chemistry offers, and which, to us at least, seem more satisfactory than the visionary teachings of Magitot, Leber and Rottenstein, and others of the fungi school.

In 1874, at Detroit, we endeavored to lay before the society our views in regard to the destructive action of acetic and lactic acids upon the teeth, as generated in the mouth from the chemical changes which starch undergoes when left to decompose about

them. Four years have wrought no change in our views upon that subject. (Trans. Am. Dental Assoc., Detroit, 1874, pp. 151, 152.)

The starchy foods permitted to remain about and between the teeth are converted by the saliva into glucose or grape sugar, the fermentation of which results in acetic and lactic acids. These acids convert the tribasic lime phosphate of the teeth into the bibasic phosphate, leaving it in a softened condition, capable of being washed out. Another lodgment of food occurs in the same pocket, to undergo the same changes, another bite by the acids results in more softening, and thus a cavity is formed.

Recently we have had some notable cases coming under our observation, showing conclusively the destructive nature of sugar upon the teeth, where it is used largely as a food, and permitted to become acidulated between and about them.

L. S., a white boy, aged eighteen, employed in a candy factory, presented himself for operations upon his teeth. An examination of the mouth showed a most deplorable condition of things. The teeth were not only decayed on their proximate surfaces, but rings of softened enamel were revealed, by the touch of the excavator, all about their necks. A. B., a colored man who had been engaged in a candy factory for twenty-five years, applied to have his teeth extracted, with a view to the construction of an artificial set. His jaws were furnished only with two rows of stumps, the teeth having dissolved away in an acid saliva. The litmus test was used in both these cases, showing decided acidity.

While speaking of the destructive nature of the sugar-acids, we would present a thought that has often occurred to us; but because of our inability to prove conclusively anything in connection with it, we would only offer it suggestively. May not oxalic acid be one of the products of the splitting of the sugar molecule in the mouth, forming the oxalate of lime by its union with the phosphate? What acid would prove more destructive, and what having a stronger affinity for lime? Oxalic acid is made on a large scale by the action of hydrate of soda and hydrate of potash upon sawdust; but it may be made experimentally by the action of nitric acid upon starch or sugar. It was long known as the acid of sugar, from this fact. Sugar has the property of forming compounds with many alkaline bases, but notably with lime. A solution of cane sugar is capable of dissolving a large quantity of lime,

forming a compound which may be represented by the formula $CaOC_{12}H_{22}O_{11}$.

It is not incredible that sugar, constantly present in the mouth, may greatly assist in the washing out of the lime-salts after they have been subjected to the disintegrating action of its acids; and this, we have thought, may account to some extent for the rapid dissolution of the teeth of individuals employed in candy factories, where sweets are kept constantly in the mouth. The experiment of Dr. Cassidy, detailed in an essay read at Chicago last year, in which he gave the result of a test of the action of acetic and lactic acids out of the mouth, go far toward proving the activity of these acids upon the lime-salts of which they are composed; but the utter impossibility of securing the same conditions that obtain in the mouth, necessarily deprives an experiment of this kind of much of its force. The theory sometimes advanced, that nitric and sulphuric acids arise from the decomposition of meats between the teeth, we think has little foundation in fact, and is rather far-fetched.

The chemical analysis of beef-flesh gives us:

Water	77.5
Albuminous matter	16.0
Fat	5.0
Mineral salts	1.5
	100.0

Now, in the putrefaction of meat, the oxidation of its albuminous portion is the first step of dissolution. The analysis of albumen may be given proximately as follows:

Carbon	52.0
Hydrogen	6.9
Nitrogen	15.6
Oxygen	24.0
Sulphur	1.5
	100.0

The carbon then would be resolved into carbonic acid, CO_2, and the hydrogen, nitrogen and oxygen into ammonia, NH_3, and water, H_2O. Then what becomes of the sulphur? Is it changed into sulphuric acid to convert the teeth into gypsum, mere plaster models of the original beautiful structure?

The odor arising from putrid flesh tells that story too forcibly to make chemical analysis necessary. HS, sulphuretted hydrogen, is formed either by an appropriation of nascent hydrogen or by the decomposition of a portion of the water present. The hypothesis that nitric or sulphuric acid may result from the putrefaction of flesh, we believe untenable. Hydrochloric acid is more readily accounted for in the breaking up of the chloride of sodium molecule; but this would have but a moderate affinity for any but the lime carbonate of the teeth.

The ammonia arising from decomposing flesh may, and we think probably does, dissolve out the animal matrix, thus furthering the progress of decay. It is not all the work of acids, and we should be careful how we recommend alkaline dentifrices in those cases where the gums have shrunken beyond the enamel border, exposing the cementum, for by so doing we may develop softened rings around the necks of the teeth.

Much attention is now being drawn to the subject of electro-chemical action as explanatory of the decay around metallic fillings, but to this we have not given sufficient thought to justify an entrance upon it. With the lights before us now, we are ready to lay down as an axiom that the greater part of dental decay arises from the decomposition of starchy and saccharine substances in the mouth.

DISCUSSION.

Dr. Atkinson: This report, like all others on special departments, entirely ignores that upon which it stands. Chemistry cannot stand alone, any more than any other department of science. What we call chemical science is but the chemical aspect of general science. You cannot have any consciousness of gathering your ideas together without a chemical process; nor is there an organization of any kind in which there is not a chemical phase in its production; and having said that, it is not worth while for me to recapitulate that which ought to be known to every graduate of any respectable school, viz., that the changes that are destined to occur, and usually do take place, in the stomach should not be asserted to transpire in the mouth, as was stated in the report we are discussing. The secretions that are possible in the mouth

cannot produce the effects attributed to them by the report. To find these we will have to go to the stomach, and give attention to investigations that are not more than ten years old, to enable us to understand the preparation of peptones and albumenoses. If we expect to have our chemistry, which is a part of our dental literature, brought to anything like a respectable status, we must make a new departure, and study it simultaneously with all the other exact sciences.